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SUPPLEMENTAL INVESTIGATION REPORT

ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

PREPARED FOR:

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST

PREPARED BY

AWD TECHNOLOGIES, INC.
INDIANAPOLIS, INDIANA

AWD PROJECT NUMBER 2259.820

MARCH 1993

AWD
TECHNOLOGIES

A Subsidiary of
The Dow Chemical Company

IND-93-BKG-413

April 1, 1993

Ms. Karen A. Vendl
Senior Remedial Project Manager
Office of Superfund
United States Environmental Protection Agency - Region V
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Subject: Phase II Supplemental Investigation Summary Report
Enviro-Chem Site Final Design
Zionsville, Indiana
AWD Project Number 2259.820

Dear Ms. Vendl:

Enclosed please find three copies of the Phase II Supplemental Investigation Summary Report. As requested, we are also sending three copies to Dr. James R. Smith of IDEM and Dr. Frank Mahuta of CH2M Hill.

If you have any questions or concerns regarding the Phase II report, please contact me.

Sincerely,

Donald A. Ruggeri Jr. For

Bradford K. Grow
Director of Operations - Indianapolis

BKG/drp

copies: R. Ball - ERM North Central
N. Bernstein - Arent Fox Kintner Plotkin and Kahn
T. Harker - The Harker Firm
J. Kyle - Barnes and Thornburg
J. Smith - IDEM (3)
F. Mahuta - CH2M Hill (3)

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EXECUTIVE SUMMARY

The Phase II Supplemental Investigation (Phase II SI) at the Enviro-Chem Superfund Site in Zionsville, Indiana was performed in January 1993 to provide the basis for design of groundwater dewatering and treatment associated with implementation of the required Soil Vapor Extraction System (SVES). As vapor extraction is most effective in dry coarse grained conditions, the moisture level of soils is important to the design of the SVE system. The remedial investigation (CH2M Hill, 1986) developed and presented data which characterized the soils at this site to be impacted with VOCs to a depth of approximately 5 feet, with levels diminishing sharply below 5 feet over a majority of the site.

From the Phase I Supplemental Investigation (AWD, October 1992) it was determined that site conditions, with respect to the higher groundwater elevation, had changed since operation of the VES Pilot Study (TerraVac, 1988). As this higher elevation may play an important role in the moisture level of soils in the treatment zone, a further phase of investigation was performed.

From this study it was determined that some dewatering may be needed to increase the effectiveness of SVE in the treatment zone.

The objectives of the Phase II SI were:

- To more accurately estimate the volume of stored groundwater to be removed and the maintenance dewatering rate necessary to operate the proposed SVES.

- To assess the hydraulic interconnection between the upper till unit and the sand and gravel unit.

- To determine the feasibility of dewatering through trenches similar to the pilot study soil vapor extraction trenches.

- To evaluate the physical stability of an open trench excavation.

As one of the goals of this study was to determine the amount of stored groundwater, a datum line had to be established. The datum chosen for the basis of stored groundwater calculations is 9 feet. This was the datum used by the VES Pilot Study, and will be referred to throughout this report.

The Phase II SI activities included:

- Excavation of five test pits (CP-TP-01 and DT-TP-01, DT-TP-02, DT-TP-03, and DT-TP-04).

- Elongation of DT-TP-01 into a 50-foot long trench known as the dewatering trench.

- Installation of two shallow and two deep (sand and gravel unit) observation piezometers (OW-1A, OW-1B, OW-2A, and OW-2B).

- Measurement of water levels in the new observation piezometers, the existing concrete pad piezometers, and monitoring wells ECC-MW-8A and ECC-MW-12.

- Short term pumping of groundwater from the concrete pad test pit (CP-TP-01) and analytical sampling of the discharge water during the discharge test.

Geological and hydraulic evaluation of the collected data was performed to meet the objectives.

The area within the remedial boundary was separated into three subsections with regard to the conclusions concerning each of the objectives. From north to south, these areas were designated: Area A, Area B, and Area C. Area A is a rectangular area north of the "Old Pond." Area B is the "panhandle" area between the southern boundary of Area A and the northern perimeter of the concrete pad. Area C consists of the remainder of the area within the remedial boundary which incorporates the concrete pad covered area.

Areas A and B had no known physical property differences, however, Areas A and B were separated because field screening during the Phase II SI suggests that soil contamination within Area A is primarily limited to the upper 5 feet of soil, and in Area B, may be somewhat lower. The hydraulic parameters were assumed to be the same for Areas A and B for purposes of the dewatering calculations. Area C was separated because different subsurface conditions were encountered in this area as compared to Areas A and B. Figure 3 presents the delineation of Areas A, B, and C.

The conclusions developed for Area A include:

- The volume of stored groundwater in the upper 9 feet of soil is presently estimated to be approximately 250,000 gallons.

- The maintenance dewatering rate is estimated to be approximately 1.1 gallons per minute (gpm) (based on 1,040 feet of "perimeter trench").

- There is a slight downward vertical gradient between the upper 9 feet of soil and the underlying sand and gravel unit. However, the collected geological data from the Phase II SI indicate that the sand and gravel unit will not have significant hydraulic effects on the upper 9 feet of soil (and therefore on the operation of the SVES) in this area.

- Dewatering the upper 9 feet of soil through trenches similar to the SVES pilot study trenches may require up to approximately 160 days (5 months) relying primarily on gravity discharge. This was estimated to be equivalent to 0.001 gallons per minute per foot of trench. Dewatering may be accelerated by operation of the SVE system.

- Trench excavations to 9 feet BGS will be stable during the initial phase of excavation.

The conclusions developed for Area B include:

- The volume of water stored in the upper 9 feet of soil is presently estimated to be 55,650 gallons.

- The maintenance dewatering rate is estimated to be 0.33 gpm (based on 308 feet of "perimeter trench").

- At the southern end of Area B, a slight upward vertical gradient was measured between the upper 9 feet of soil and the underlying sand and gravel unit.

- The time estimated to dewater the upper 9 feet of soil through trenches similar to the SVES Pilot Study trenches is approximately the same as in Area A - 160 days, which may also be accelerated through operation of SVE.

- Trench excavations to 9 feet BGS will be stable during the initial phase of excavation.

The conclusions developed for Area C include:

- The volume of stored groundwater in the upper 9 feet of soil is presently estimated to be approximately 246,000 gallons. Of this total, 105,500 gallons were estimated to be contained in the gravel subbase of the concrete pad.

- The pumping test results suggest that the sand and gravel unit may be hydraulically connected to the upper 9 feet of soil in this area. This possible connection may be naturally occurring, or could be the result of the present "EPA Sump" and Monitoring Well ECC-12 that apparently extend into the sand and gravel unit.

- The maintenance dewatering rate is estimated to be approximately 4 gpm (based on 584 feet of "perimeter trench"). This estimate, based on an assumption of connection (which must be verified in Phase III), includes approximately 2 gpm from horizontal seepage (out of the upper 9 feet of soil) and 2 gpm from vertical leakage from the underlying sand and gravel unit.

- Trench excavations to 7 feet BGS will be stable during the initial phase of excavation provided that construction dewatering is performed. Based upon the Phase II field work, a trench deeper than 7 feet may need reinforcement prior to construction because of caving conditions.

In addition to the hydraulic data collection and evaluation, some relative analytical soil data (head space measurements) and quantitative analytical groundwater data (pumping test discharge sampling and analysis) were collected. These field screening data suggested that volatile organic contamination of the soil may exist in the southern portion of Area B and in Area C down to 9 feet BGS, and down to 3 feet BGS in Area A. The groundwater beneath the concrete pad presently exceeds nearly all of the acceptable subsurface water criteria presented in the current Consent Decree.

Two primary recommendations have been developed through the performance and evaluation of the Phase II SI:

- A Phase III supplemental investigation (Phase III SI) should be performed to understand why Test Pit CP-TP-01 was unable to be dewatered in the Phase II, and to better understand the southern portion of the site.

- A study of a possible water management system should be performed subsequent to the Phase III SI to determine the best methodology to handle the predicted groundwater discharge from the dewatering system, if such a system is employed in each of the three areas. Other alternatives with respect to Area C will also be evaluated depending on the results of the Phase III study.

1

1.0 INTRODUCTION

This document presents a data summary and evaluation of the Phase II Supplemental Investigation (Phase II SI) performed at the Enviro-Chem Superfund Site in Zionsville, Indiana, by AWD Technologies, Inc. (AWD). The Phase II SI field activities, performed from January 4 through 13, 1993, were outlined in the Phase II SI Work Plan, dated December 18, 1992 (AWD, December 1992). The Phase II SI was intended to be used to establish the basis of design for groundwater management at the site.

The potential need for dewatering related to the proposed Soil Vapor Extraction System (SVES) design was identified through the Phase I Supplemental Investigation (AWD, October 1992). The Phase I SI identified the apparent elevation of the water table at the site as compared to previous investigations (ERM, 1988 and CH2M Hill, 1986). The existence of the water table above a depth of 9 feet complicates the operation of the SVES. The Vapor Extraction Pilot Test (ERM, 1988) indicated at that time that groundwater was not encountered at depths above 9 feet, and the preliminary design based on that pilot test did not address the need for, or design of, a dewatering and treatment system. The Phase II SI was therefore developed to collect the data needed for groundwater management design.

Preliminary dewatering calculations were made through the Phase I SI to estimate the volume of groundwater that may need to be removed. As a result of the data collected during the Phase I SI, and the preliminary Phase I SI dewatering calculations, the Phase II SI was developed to confirm the present depth to the water table at the site, and more accurately estimate the water management issues associated with the installation and operation of the SVES.

The Phase II SI field activities were performed under oversight from representatives of U.S. EPA Region V contractor, CH2M Hill, Inc. on January 5 through 9, 1993, and through direct observation by the U.S. EPA Project Manager, Ms. Karen Vendl, on January 7 and 8, 1993.

2.0 SCOPE OF WORK

2.1 Objectives

The objectives of the Phase II SI were:

- To more accurately estimate the volume of stored groundwater to be removed and the maintenance dewatering rate necessary to operate the proposed SVES.

- To assess the hydraulic interconnection between the upper till unit and the sand and gravel unit.

- To determine the feasibility of dewatering through trenches similar to the pilot study soil vapor extraction trenches.

- To evaluate the physical stability of an open trench excavation.

The Phase II SI was intended to provide sufficient data for completion of the final remedial design and implementation of that final design.

2.2 Planned Tasks

The Phase II SI was comprised of eight primary tasks. These tasks included:

- Task 1 - Work Plan Development
- Task 2 - Mobilization
- Task 3 - Dewatering Trench Excavation and Construction
- Task 4 - Observation Piezometer Installation
- Task 5 - Dewatering Trench Hydraulic Testing
- Task 6 - Backfill and Cover Trenches
- Task 7 - Surveying
- Task 8 - Phase II SI Data Evaluation and Summary Report

Task 1 consisted of the development of the scope of work, the methodologies to be employed to complete the scope of work, and the preparation of the work plan outlining the Phase II SI activities. Task 2 involved the mobilization of manpower and equipment necessary to complete the Phase II SI. Tasks 3 through 7 represented the activities that were planned to be completed in the field. The development and presentation of this report is the product of Task 8.

Tasks 3 through 7 included the planned excavation of two test pits (one through the concrete pad), the planned excavation and construction of a dewatering trench at the north end of the site, installation of three shallow observation piezometers and one deep observation piezometer along the planned dewatering trench, hydraulic testing (pumping from) of the dewatering trench, and short-term pumping from the concrete pad test pit. These activities were planned based on the data available within the remedial boundary prior to the start of the Phase II SI.

2.3 Work Plan Changes

The proposed test pits were excavated as stated within the Phase II SI Work Plan. These test pits were assigned the following identification: CP-TP-01 for the pit within the concrete pad and DT-TP-01 for the dewatering trench test pit at the northern end of the site. Figure 1 presents the locations of the completed test pits. Both of the originally planned test pits were excavated to a depth of 9.5 feet.

After successful completion of the test pits, it was observed that the northern test pit did not encounter significant waterbearing sand lenses within the target depth of 9 feet, and very little (immeasurable) groundwater was seeping into the pit. This test pit (DT-TP-01) was then elongated 25 feet eastward and 25 feet westward from its center. The elongated excavation was then identified as the "dewatering trench". The planned dewatering trench was excavated, as required by the work plan, in an effort to identify the presence of any near-surface waterbearing zones. The excavated trench was excavated to 9 feet below ground surface (BGS) at the western end to 10 feet BGS at the eastern end over its total length of 50 feet. The trench walls were very stable with only minor collapse around an approximately 1 square foot seepage zone near the center of the trench. A field decision was made to discontinue construction of the planned drain within the dewatering trench, and excavate several more test pits to confirm the local subsurface conditions.

Three additional test pits were excavated while the dewatering trench was left open overnight to observe any potential groundwater seepage prior to backfilling with the excavated material. The additional test pits included:

- DT-TP-02 - 30 feet southeast of DT-TP-01, excavated to the maximum digging depth of the backhoe.

- DT-TP-03 - 20 feet north of the concrete pad, slightly north of the soil embankment/berm that exists along the northern perimeter of the concrete pad, excavated to 11.5 feet BGS.

- DT-TP-04 - at the southeast corner of the present tank storage area within the western portion of the site, excavated to the maximum digging depth of the backhoe.

Figure 1 presents the locations of the additional test pits. Test Pits DT-TP-02 and DT-TP-04 were excavated deeper than the 9 foot target depth (14 and 15 feet, respectively at those locations) in order to determine where the first free groundwater would be encountered. These test pits were completed at the maximum digging depth of the backhoe without encountering significant groundwater release. Test Pit DT-TP-03 was extended to a depth of 11 feet which was 2 feet deeper than the first depth at which measurable groundwater seeped into the test pit. All of the additional test pits were backfilled with the excavated soil upon completion except for DT-TP-03 which was left open overnight for observation prior to backfilling.

The observation piezometers were originally planned to measure water level effects during pumping of the dewatering drain. Despite abandonment of trench construction, four observation piezometers were installed to confirm subsurface hydrogeological conditions within the remedial boundary. Two piezometer clusters consisting of one shallow and one deep piezometer were installed. One of these clusters was located 40 feet east of DT-TP-01 and one 15 feet west of DT-TP-03. Figure 1 presents the locations of the piezometer clusters.

The shallow piezometers are screened from a depth of 9 feet to 4 feet BGS. The deep piezometers are screened across the upper 5 feet of the sand and gravel unit. Confirmatory split spoons were taken to identify the lithologic contacts in addition to using the geologic logs from the adjacent test pits. The observation piezometers were designated OW-1A and OW-1B (shallow and deep piezometers near DT-TP-03) and OW-2A and OW-2B (shallow and deep piezometers near DT-TP-01). The piezometer clusters were intended to confirm the hydrogeological conditions within the upper 9 feet of soil (north of the concrete pad) and the vertical hydraulic relationship between the (known) saturated sand and gravel unit and the upper 9 feet of soil.

The originally planned hydraulic testing (Task 5) included the full scale pumping of the dewatering trench drain over a minimum of 3 days, and measurement of the pumping effects. This original task also included short term pumping out of the test pit on the concrete pad to determine the short term discharge rate available from the gravel subbase and shallow soil under the concrete pad. The full scale pumping and measurement were not performed during the Phase II SI because of the minimal seepage encountered within the dewatering trench excavation, and the subsequent decision not to construct the drain in the trench. The short term pumping of the concrete pad test pit was performed on January 10, 1993 and is described in Section 3.3.

In summary, the completed Phase II SI field activities included:

- Excavation of five test pits (CP-TP-01 and DT-TP-01, DT-TP-02, DT-TP-03, and DT-TP-04).

- Elongation of DT-TP-01 into a 50 foot long trench known as the dewatering trench.

- Installation of two shallow and two deep (sand and gravel unit) observation piezometers (OW-1A, OW-1B, OW-2A, and OW-2B).

- Measurement of water levels in the new observation piezometers, the existing concrete pad piezometers, and monitoring wells ECC-MW-8A and ECC-MW-12.

- Short term pumping of groundwater from the concrete pad test pit (CP-TP-01) and analytical sampling of the discharge water during the discharge test.

3

3.0 DATA PRESENTATION

3.1 <u>Site Geology</u>

Five test pits and four observation piezometers were installed as part of the Phase II SI. Each of the test pits and piezometers was observed and logged by the onsite hydrogeologist during excavation and drilling. The collected geological data were intended to confirm the characteristics of the upper 9 feet of soil, and the depth to the sand and gravel unit. Appendix A presents a photographic log of site activities that includes photographs of the test pits at varying depths.

The northern two-thirds of the site was covered with a clayey soil cap and vegetated during the U.S. EPA emergency removal action in 1984. The southern one-third of the site is covered by a concrete pad that was surficially cleaned during the U.S. EPA actions. The soil cover consists of brown to orange silt and clay that was hard and damp during the Phase II SI. The soil cover was mounded over the former location of the sludge pond to promote surface drainage. In other areas of the soil cover, standing water was present at ground surface, and within the upper foot of soil (root zone), due to approximately 2.5 inches of precipitation prior to the start of Phase II SI field activities.

Figure 2 presents a geological cross section derived from the data collected during the Phase II SI, and supported by data compiled during the Phase I SI, as presented in Figure 5 of the Phase I SI Report (AWD, October 1992). Appendix B provides the geological logs of the test pits and observation piezometers that are the basis for the cross section.

3.1.1 Areas A and B

Designated Areas A and B comprise the northern two-thirds of the site, north of the concrete pad. These areas are discussed together in Section 3.0 because the observed geology is similar. They are discussed separately, however, in Section 4.0 because of the potential difference in vertical extent of contamination between the areas, and the implication of the extent of contamination on the selected remedial design. Figure 3 presents the delineation of Areas A, B, and C.

The first naturally occurring sediment beneath the soil cover can be characterized as brown silt and clay with little gravel. The brown silt and clay was observed to be generally moist with no observed groundwater seepage within 4 feet of ground surface. The brown silt and clay graded into a gray silt with little fine sand and rock fragments at approximately 4 to 5 feet BGS. This material contains varying percentages of clay dependent on the location and was observed to contain minor (less than 1 gallon per minute (gpm)) waterbearing sand lenses. The grain size and distribution of the gray silt appears to be very consistent across the area to depths ranging from 11 feet at the northern end of the site to 9 feet north of the concrete pad near DT-TP-03.

The gray silt was observed to contain several minor sand lenses above a depth of 9 feet, and at least one sand lens between 9 and 11 feet in depth consisting of brown to gray coarse sand that appears to be continuous across the site. This sand lens initially yielded water to DT-TP-03 at an estimated 1 to 2 gpm prior to stabilization. The sand lens encountered at DT-TP-03 was the only occurrence of measurable groundwater seepage into any of the pits north of the concrete pad at a depth of 9 feet or above.

The gray silt appears to become more clay-rich at depths below the waterbearing sand lens (13 to 15 feet BGS), and it also becomes noticeably wet (in hand sample) at approximately 14 to 15 feet BGS. The fined grained sediments above this depth were generally identified as "moist." However, the observation of slight seepage in the test pits at depths between 4 and 6 feet BGS lead to the theory that the water table was approximately 5 feet BGS. The depth to the water table was confirmed by the installation and measurement of the OW-A series wells.

The sand and gravel unit was intersected at a depth of 19 feet BGS at OW-2B and 18 feet BGS at OW-1B. The drilling of the observation piezometers indicates that there is 9 to 10 feet of sediment between the bottom of the proposed SVES trenches (9 feet BGS) and the top of the sand and gravel unit in this area. The upper 5 feet of the sand and gravel unit was characterized as gray to black coarse sand and gravel (well graded).

3.1.2 Area C (Concrete Pad Area)

The surface of the concrete pad is roughly at the same elevation as the top of the first naturally occurring sediment beneath the soil cover to the north. The concrete pad at Test Pit CP-TP-01 was 0.3 feet (3.5 inches) thick and was unreinforced. A gravel subbase consisting of gray angular cobbles (3 to 4-inch diameter gravel) with some silt was present from the base of the concrete to a depth of 2 feet. The material directly underlying the gravel subbase was a brown to gray silt and clay that was characterized as wet and soft. This material, although similar to the upper 2 to 4 feet of naturally occurring sediment north of the concrete pad, is found at a noticeably lower elevation than the brown silt and clay to the north and has a much softer consistency. It is possible that this material is a natural soil deposit, but it does not appear that it is the same material as encountered north of the concrete pad. Both the gravel subbase and the underlying finer grained sediment were obviously saturated upon excavation of CP-TP-01, and dewatering had to be performed to continue excavation of the test pit below 4 feet.

The brown silt and clay extended to a depth of 5 feet where a relatively sharp contact was observed with a gray clay with little fine sand and small rounded gravel. The gray clay graded with depth to a gray silt and fine sand that was very similar to the material just above the top of the sand and gravel unit as encountered at OW-2B. The concrete pad test pit was completed at a depth of 9.5 feet BGS and allowed to fill with water upon completion.

3.2 Hydrogeological Conditions

3.2.1 Previous Studies

The data compiled and collected during the Phase I SI (AWD, October 1992) lead to the determination that the water table at the site had apparently risen above the "9 foot below ground surface level" which was reported in the Vapor Extraction Pilot Test (ERM, July 1988). The Phase I SI findings were based on the September 1992 measurement of water levels in the concrete pad piezometers, the existing monitoring wells, and the SVES standpipes. These standpipes are PVC riser pipes that are connected to the drainage pipes that were installed by Terra Vac as part of the Vapor Extraction Pilot Test (ERM, 1988). The pad piezometers indicated that the sediment beneath the pad was saturated to within 1 to 2 feet of ground surface and an adjacent shallow monitoring well (ECC-MW-11A) indicated that the shallow till outside of the concrete pad was saturated at an approximate depth of 3.5 feet (AWD, October 1992). In addition, water level measurements from the SVES standpipes matched the relative elevation (and anticipated hydraulic gradient) of the shallow groundwater measured under the concrete pad. The SVES standpipes were the only available source of groundwater data in the upper glacial till unit within the remedial boundary.

The geological data presented by the Site Remedial Investigation (Site RI) (CH2M Hill, 1986) generally support the additional information collected by the Phase II SI activities. The reported site geology identified the upper glacial till and sand and gravel unit. It also reported that the stratigraphy is very complex at the "south end of the Enviro-Chem Superfund Site" where there is "a combination of till, outwash, and alluvial deposits".

The Site RI described four hydrogeologic units as follows (from top to bottom):

- A shallow saturated zone consisting of clayey silts and silty clays approximately 5 to 15 feet below ground surface. The lithology of this unit is areally heterogeneous.

- A sand and gravel zone, approximately 15 to 30 feet below ground surface, that may be semiconfined in places.

- A thick zone of clayey silts and silty clays, approximately 30 to 150 feet below ground surface. This unit appears to act as an aquitard.

- A deep confined aquifer consisting of sand and gravel, approximately 150 to 165 feet below ground surface.

The upper two units identified in the Site RI were generally found to be similar within the Remedial Boundary by the Phase II SI work but the sand and gravel unit (or its equivalent) is closer to ground surface at the south end of the site.

All of the monitoring wells installed during the Site RI, except for ECC-MW-3A and ECC-MW-11A, were screened in the sand and gravel unit. Wells ECC-MW-3A and ECC-MW-11A were screened in the shallow glacial till. The RI Report (CH2M Hill, 1986) stated that the water levels in the wells screened in the sand and gravel "may not represent the depth to the saturated zone". The depth to the saturated zone, however, can be compared between the Site RI time period and the Phase II SI water level measurements through examining the water level measurements of ECC-MW-11A. The water level in ECC-MW-11A during the Site RI was measured to be 3.43 feet BGS, and the February 3, 1993 measurement was 3.32 feet BGS. If ECC-MW-11A is assumed to be of good integrity, then the hydrogeological conditions between the Site RI and the Phase II SI in the shallow glacial till can be assumed to be relatively the same.

3.2.2 Current Hydrogeologic Interpretation

Based on the data collected from the test pits, dewatering trench excavation, and observation piezometers, the current hydrogeological interpretation is as follows:

- Site hydrogeological conditions within the zone above the sand and gravel unit change from north to south with significantly different conditions occurring beneath the concrete pad.

- The water levels exhibited by the SVES Pilot Study standpipes appear now to be representative of surface water that infiltrates into the sandpack within the SVES trenches and not a high water table. This water becomes trapped in the sandpack or drain pipe due to the low permeability of the sediment around the trenches. The standpipe surface seals, if installed, are probably leaking. This interpretation is enhanced by the comparison of water levels in the standpipes between September 1992 and January 1993. Water in the standpipes during the Phase II SI was very near ground surface indicating direct influence from the precipitation event that preceded the start of the Phase II SI. This same effect was observed during the Phase I SI, and was reported as an apparent high water table.

- Saturation of the till north of the concrete pad is generally 5 feet BGS or greater, and the low permeability of the soil encountered above 9 feet in depth limits a measurable discharge of the groundwater from the soil to a test pit or borehole.

- Saturation of the soil above the 9 foot depth beneath the concrete pad is not limited to the gravel subbase, and the sediment beneath the gravel subbase is capable of providing a sustained groundwater discharge after dewatering of the gravel subbase.

The hydrogeological interpretation that follows in the next two subsections is based on the observation of subsurface excavation and drilling during the Phase II SI and the water level measurement of the newly installed observation piezometers and existing piezometers within the remedial boundary. Table 1 presents a summary of the test pit and observation piezometer details. Table 2 provides a summary of water level measurements from both the Phase I SI and the more recent measurements taken during the Phase II SI. Appendix C provides the well construction details for the observation piezometers.

3.2.3 Areas A and B

3.2.3.1 General Conditions

The areas north of the concrete pad can be generally characterized as consisting of low permeability silt and clay (glacial till) from the contact of the soil cover downward to the top of the sand and gravel unit. The top of the water table is estimated to be approximately 5 feet BGS in this area. This is based on the measured water levels in the OW-A series wells and the seepage observations from test pits DT-TP-01, DT-TP-02, DT-TP-03, and DT-TP-04. The water levels in the OW-A series wells (at last measurement on February 3, 1993) were between 5 and 6 feet BGS. The water levels in these wells rose very slowly, therefore, the head levels exhibited on February 3, 1993 are not considered "static." Slight seepage was consistently noted in the test pits between 4 and 6 feet BGS. The 5-foot BGS value is used in the dewatering calculations for Areas A and B.

The fine grained soil below the water table did not release appreciable quantities of water to an open test pit. Based on these conditions, the saturated soil above 9 feet in depth will not easily yield water to a dewatering trench. The soil, both above and below the water table, was very stable, providing for easily excavated trenches with relatively solid side walls.

The groundwater conditions described in the preceding paragraph were observed in Test Pits DT-TP-01, DT-TP-02, DT-TP-03, and DT-TP-04. During the U.S. EPA RI (CH2M Hill, March 1986), several shallow test pits (less than 5 feet in depth) were excavated north of the concrete pad. Two of these test pits intersected saturated coarse sand and gravel at depths above 4 feet that rapidly discharged water to the test pits and filled them with water. These test pits, identified as TP-7 and TP-8, were excavated in the extreme western and northwestern sections of the site where the cleaned tanks are presently staged. These conditions were not encountered in any of the Phase II SI activities north of the concrete pad and could have been the result of manmade conditions during operation of the tank farm.

3.2.3.2 Local Hydraulic Conditions

The water level information obtained from the shallow observation piezometers indicates the hydraulic conditions within the upper 9 feet of soil. Shallow observation piezometer OW-2A was dry at 9.0 feet BGS 2 days after completion despite the intersection of minor seepage zones at 5 and 6 feet BGS as encountered in DT-TP-01 and DT-TP-02, respectively. Groundwater slowly seeped into OW-2A over the next 3 weeks. Water level measurements recorded on February 3, 1993 showed that OW-2A had a water level of 5.41 feet BGS. As shown on Figure 2, the first encountered waterbearing sand lens within the till at the OW-2A location was approximately 11 feet BGS. This information demonstrates the low permeability of the soil above the 9 foot depth in the northern portion of the site and the inability of that soil to yield water to an open space over a short period of time (i.e., not easily dewatered).

Observation piezometer OW-1A exhibited a water level of 7.96 feet BGS upon completion that continued to slowly rise to 7.90 feet BGS 2 days after completion. As in OW-2A, groundwater continued to slowly seep into OW-1A. The February 3, 1993 measurement exhibited a water level of 5.58 feet BGS. The groundwater collected by OW-1A is representative of the sand lens at 9 feet BGS but the piezometer is also screened across a thin sand lens between 6.5 and 7.3 feet BGS as characterized during drilling. The slow rise of the water level in OW-1A is also indicative of the low permeability of the soil and the inability of the saturated soil to yield water over a short time period.

The Site RI (CH2M Hill, 1986) reported that the hydraulic conductivity of the shallow saturated zone was estimated to be 1.0×10^{-5} centimeters/second (cm/sec) from grain size analysis and 4.9×10^{-4} cm/sec from slug tests performed on wells within this zone at the neighboring Northside Sanitary Landfill. Slug tests performed during the Phase I SI (AWD, 1992) ranged from 4.4×10^{-10} cm/sec in Well ECC-MW-11A to 5.6×10^{-3} cm/sec in Well ECC-MW-8A. The range of hydraulic conductivities observed during the Phase I SI were thought to represent "low permeability" in the shallow zone, and the somewhat greater permeability in the sand and gravel unit. The 1.0×10^{-5} cm/sec value was accepted as the "hydraulic conductivity of the shallow till" for Areas A and B; and an order of magnitude greater value (1.0×10^{-4} cm/sec) was adopted for Area C (the concrete pad area) because of the increase in grain size and water production (and the existence of the gravel subbase).

Unlike the overlying fine grained soil, the sand and gravel unit freely yields groundwater to an open borehole with a measured water level that rose to within 4.5 feet of ground surface. The water within the sand and gravel unit north of the concrete pad is under confined conditions. There is a slightly downward vertical gradient from the fine-grained till to the sand and gravel unit in Area A that indicates the potential for upward discharge is limited under static conditions. The vertical gradient apparently reverses itself as groundwater flows southward. There is a slight upward vertical gradient in the southern section of Area B (at OW-1A and OW-1B) which suggests that the potential for upward discharge to the till from the sand and gravel unit currently exists in this area.

3.2.4 Area C (Concrete Pad Area)

3.2.4.1 General Conditions

The hydrogeological conditions in Area C (beneath the concrete pad) are markedly different from the conditions described in Section 3.2.3 for Areas A and B. The most significant difference is the presence of saturated sediment at very shallow depths (less than 2 feet BGS) that yields measurable quantities of groundwater. There are several reasons for the shallow saturated conditions and the groundwater yield beneath the concrete pad which include:

- The concrete pad is underlain by very coarse gravel subbase that acts as a storage basin for direct infiltration of precipitation that migrates through the concrete pad and along its perimeter into the subbase. This gravel fill was 1.5 feet thick at CP-TP-01.

- The concrete pad is at the lowest elevation of the site and receives some surface runoff from points north of the pad. This runoff is limited however because of the soil berm north of the pad that was installed as part of the U.S. EPA actions and the drainage swales that were intended to direct water around the pad.

- The soil beneath the gravel subbase (especially the gray colored sediment) contains more sand than the corresponding sediment to the north therefore, having an apparent greater permeability.

- The thickness of soil between the first waterbearing sand lens and the ground surface is lesser at the south end of the site (7 feet) as compared to the north end of the site (below 11 feet).

- The present sump (and historical sump) at the southeast corner of the pad extends, at a minimum, to 12 feet BGS. This construction physically connects the gravel subbase to the underlying waterbearing sand lens(es) above the sand and gravel unit and possibly the sand and gravel unit. This results in a flow path between the sand and gravel unit and the sump.

- Monitoring Well ECC-12 is screened through the present sump and a portion of its screen apparently extends into the top of the sand and gravel unit. The construction of this well creates the potential for an additional hydraulic connection between the fine grained sediment and the sand and gravel unit (Figure 2).

- Historically, the area which is covered by the concrete pad was wet in aerial photographs. This indicates the potential for the lowlying area to collect surface water, and the hydraulic influence of the underlying sand and gravel unit on near surface sediments because it is nearer ground surface in this area due to the decrease in land surface elevation toward the regional drainage system (Finley Creek).

These points summarize the primary hydrogeological differences between the southern portion of the site under the concrete pad and the north area of the site.

3.2.4.2 Local Hydraulic Conditions

The static water level beneath the pad was measured to be slightly below the top of the gravel subbase at CP-TP-01 and was above the base of the concrete pad (within inches of the pad surface at Piezometers PZ-7 and PZ-8) at the south end of the site at the start of the Phase II SI. The static water elevation ranged from 884.3 at the northwest corner of the pad to 883.1 at the southeast corner of the pad (Table 2). This water level, however, is not solely reflective of water contained within the gravel subbase.

Upon excavation of CP-TP-01, large volumes of water were entering the pit from the gravel subbase. Dewatering was performed with a 2-inch trash pump to continue the excavation below the gravel subbase. The discharge water was stored in a 20,000 gallon storage tank (frac tank) that was staged adjacent to the test pit. Water discharge from the gravel lessened after the first hour of pumping and the subbase was locally dewatered prior to completion of the test pit. The sediment underlying the gravel subbase to a depth of 9 feet was also saturated and continued to yield water during excavation of the test pit. The sustained pumping rate during construction dewatering was slightly greater than 5 gpm.

After completion of the test pit, the pit was quickly dewatered (pumping at greater than 20 gpm) to observe the condition of the test pit walls. The test pit walls remained stable to a depth of 7 feet BGS. Beneath 7 feet BGS, the sand lens(es)/grain size of the till and the saturated conditions caused collapse of the side walls shortly after completion.

There is a downward vertical gradient between the fine grained soil and the sand and gravel unit beneath the concrete pad. The water levels measured in the shallow concrete pad piezometers are approximately 3 feet higher than that measured in the sand and gravel unit at Well ECC-MW-8A. Well ECC-MW-11A, which is slightly west of the concrete pad and screened in the shallow till, exhibited a water level that is approximately 1.0 foot higher than the level measured in Well ECC-MW-8A which is screened in the sand and gravel unit. The downward vertical gradient indicates the potential for recharge of the sand and gravel unit from the overlying fine grained sediment under static conditions. This vertical gradient could be reversed however when the fine grained sediment is dewatered and result in upward seepage from the sand and gravel unit into the dewatering system.

As stated in the previous section, February 3, 1993 measurements of OW-1A and OW-1B indicate a naturally occurring, slightly upward vertical gradient north of the concrete pad where there is no hydraulic influence from the gravel subbase. The reversal of the vertical gradient between the south end of Area B and Area C is most likely caused by hydraulic influence from the water stored in the gravel subbase.

3.3 Hydraulic Testing of CP-TP-01

As described in Section 2.3, the hydraulic testing that was performed as part of the Phase II SI consisted of the short term pumping of the test pit on the concrete pad (CP-TP-01) and the manual observation of water levels in the two nearest concrete pad piezometers (PZ-3 and PZ-5) and Monitoring Well ECC-MW-8A. Piezometers PZ-3 and PZ-5 are screened through the gravel subbase and into the shallow fine-grained sediment; Monitoring Well ECC-MW-8A is screened in the sand and gravel unit. The pumping test of CP-TP-01 was performed on January 10, 1993 for 195 minutes (3.25 hours). The test consisted of the variable rate discharge of groundwater from the pit using a 2-inch trash pump. Flow was controlled by a gate valve and measured with an inline flow meter. The discharge rate was set at 1.3, 4.5, and 8 gpm over the pumping period. Discharge water was pumped into the frac tank that had received the construction dewatering discharge. An inline sampling port was used to take a sample of the discharge water at approximately 140 minutes into the test. Appendix D contains the collected pumping test data including the time-drawdown curves from the test pit and observation piezometers.

Maximum drawdown of the water level in the test pit at the end of the pumping test was 1.24 feet below the initial level of 0.88 feet BGS. Pumping at 1.3 gpm produced slightly more than 0.1 feet of drawdown over 35 minutes of pumping. When it became obvious that the test pit could yield more than the initial discharge rate, the rate was increased to 4.5 gpm. Pumping continued at 4.5 gpm for approximately 140 minutes. The water level remained relatively constant for 30 minutes into the 4.5 gpm pumping period and then dropped steadily until the water level was lowered beneath the gravel subbase. The steady decrease in water level continued until approximately 125 minutes into the test (90 minutes into the 4.5 gpm interval). At 125 minutes, the water level in the pit began to stabilize and remained relatively constant until the final pumping rate was begun at 176 minutes into the test. The final pumping rate of 8 gpm initially decreased the water level in the pit by approximately 0.3 feet but the water level again stabilized prior to completion of the test.

Effects of the pumping from CP-TP-01 were monitored in concrete pad piezometers PZ-3, PZ-5, and monitoring well ECC-MW-8A. The pumping created very little drawdown within the observation points. The maximum drawdown obtained was in the closest piezometer, PZ-5, in which 0.19 feet of drawdown was recorded at the end of the pumping period.

Despite the relative lack of drawdown in the observation piezometers, the drawdown data coupled with the data from the test pit itself, indicate several interesting events that support the field observations that the water under the pad is not solely representative of surface water that has been trapped in the gravel subbase. The most obvious occurrence was the ability of the water level in the pit to sustain itself at 4.5 gpm after the water level had been lowered beneath the gravel subbase. Since the discharge water was being securely stored in the frac tank and the prevailing weather conditions were overcast and subfreezing, direct recharge from the discharge water or melting snow was ruled out. In addition, the drawdown curve of PZ-5 began to flatten after 100 minutes and the water level in the sand and gravel well, ECC-MW-8A, began to decrease. The combination of these measurements suggests hydraulic influence (derivation of water) from the underlying sand and gravel unit or greater than expected flow contribution directly from the fine grained sediments. The degree of hydraulic connection between the sand and gravel unit and the overlying fine grained soil cannot, however, be determined through the Phase II SI data.

The inferred hydraulic connection between the sand and gravel unit and the fine grained sediment is most probably naturally occurring. However, the construction of existing Well ECC-MW-12 and the "EPA Sump" also provides a conduit for direct hydraulic connection between the sand and gravel unit, the fine grained sediment, and the gravel subbase.

3.4 Previous Dewatering Efforts

The results of the Phase II SI pumping test of the concrete pad test pit are supported by data collected by the U.S. EPA during part of the emergency removal action in 1985 as presented in the On Scene Coordinator's Report, dated June 6, 1988 (Simes, June 1988). These data were presented only as supportive information to the physical removal (pumping) of more than 25,000 gallons of water from under the concrete pad. The data were not collected within the framework of a hydrogeological evaluation but can be applied to support the Phase II SI pumping test results.

The objective of this action was to stop seepage discharge of contaminated water from under the pad. The action was based on the premise that the water beneath the pad was solely the result of surface water infiltration and retention, and that this finite volume of water could be removed. After removal, provisions could be made to mitigate the reinfiltration of water into the gravel subbase. These provisions included the soil cap of the site, the soil berm north of the pad, and the drainage ditch south of the pad.

The emergency removal action consisted of the construction and pumping of the present sump at the southeast corner of the pad and the installation of the concrete pad piezometers (PZ-1 through PZ-8). Pumping was performed intermittently from April 22 to April 24, 1985. The report indicates that the initial pumping rate was 15 gpm which decreased to 2 gpm at the end of pumping. A total of 25,000 gallons of water was reportedly removed over the pumping period.

The initial calculations made by the U.S. EPA estimated 30,000 gallons of water to be stored in the gravel subbase. This estimate was based on a pad that was 200 feet in length, 135 feet in width, had a gravel thickness of 0.5 feet, and a 30 percent porosity of the storage medium. The removal of 25,000 gallons of water was determined to have successfully reduced the seepage discharge that was ongoing at the time. However, despite the conclusion by the report that the "area" had been successfully dewatered, the data collected from the concrete pad piezometers showed that the pumping had only created 1.73 feet of drawdown in the nearest piezometer to the sump, and that there was no drawdown observed in the piezometers at the north end of the pad.

The interpretation of these data within the context of a hydrogeological evaluation indicates that the emergency removal was successful in dewatering the coarse gravel subbase at the southern end of the site but was not successful in dewatering the saturated sediment beneath the subbase at the southern end of the site, and had little effect (if any) north of PZ-4. These results further support the conclusion from the Phase II SI testing that the groundwater beneath the pad, and recharge to that groundwater, is not limited to the gravel subbase and short-term infiltration of precipitation.

3.5 Soil and Groundwater Analyses

The chemical analysis and evaluation of site soils and groundwater were not primary objectives of the Phase II SI, and no attempt has been made to interpret the results of the field headspace monitoring of soils and the analysis of the collected groundwater discharge sample on a statistically significant basis. The chemical screening and analyses that were performed as part of the Phase II SI included:

- Headspace measurement of soil samples collected from the test pits and observation piezometer test borings.

- Field screening of excavated soil for radiological hazards.

- Sampling of well ECC-MW-12 prior to the start of excavation activities to obtain approval for disposal prior to collection of the anticipated waters at the selected commercial disposal facility.

- Sampling of the groundwater discharge from the short term pumping test for comparison to the cleanup criteria contained in Table 3-1 of the draft Consent Decree.

3.5.1 Soil Headspace Measurements

The soil headspace results suggest that volatile organic contamination exists in the southern portion of Area B, and in Area C, to depths down to at least 9 feet BGS. The maximum headspace measurement obtained during excavation in these areas was from DT-TP-03 (between the old pond and the concrete pad) at a depth of 9 feet BGS. The soil from this depth, and the open excavation, created sustained photoionization detector (PID) readings of nearly 5 parts per million (ppm) in the breathing zone. The soil from the test pit within the concrete pad at a depth of 9 foot was also contaminated with volatile organics but at lesser measured readings than the soil from DT-TP-03.

Of the soil samples collected from the test pits in Area A (DT-TP-01 and DT-TP-02) only the first sample at DT-TP-01, at a depth of 3 feet BGS, had a measurable reading on the PID. An apparently isolated section of contamination was discovered when an old drain pipe (6-inch PVC) was unearthed at approximately 15 feet west of the center point on the dewatering trench excavation. This pipe appeared to extend from the old process building to the north drainage ditch. The pipe was filled with a dark colored sludge that registered over 700 ppm. There was no discoloration of the soil around the pipe but the pipe was at the approximate depth of the soil sample from DT-TP-01 (15 feet to the east) that exhibited a positive headspace reading.

In summary, the soil headspace measurements suggest the existence of volatile organic contamination of the soil down to a minimum depth of 3 feet in Area A and at least 9 feet in the south end of Area B, and in Area C. The records of the headspace measurements are included on the geologic logs in Appendix B.

3.5.2 Radiological Screening Results

It was reported that 20,000 pounds of potentially low level radioactive waste had been stored at the Enviro-Chem Site. A review of the available waste tracking information could not confirm the characterization of the waste and whether the waste had been removed from the site.

As a precaution, radiological surveying of each excavation site and the excavated soil was performed with a Bicron-S-50 RAD meter. No elevated radiation levels were detected during the Phase II SI activities.

3.5.3 Groundwater Analyses

In order to prepare for collection and disposal of groundwater during the Phase II SI, well ECC-MW-12 was sampled to arrange for disposal approval of the waste stream to the selected commercial disposal facility, Clean Harbors, Inc., in Chicago, Illinois prior to collection of the water. Well ECC-MW-12 was selected because groundwater samples from that well were historically the most contaminated of the samples taken from the wells north of the Northside Sanitary Landfill access road. The pre-activity sampling of the well was performed for two reasons: (1) sampling of the most contaminated well would provide a "worst case" condition for the predicted waste stream, and (2) the preapproval would allow for immediate removal of the staged water either during or following completion of the hydraulic testing. Two quarts of water from the well were packaged and shipped to the disposal facility once three volumes had been removed from the well to insure a representative sample. The purge water was collected in a 55-gallon drum and staged on the concrete pad with the other staged drums. The disposal facility subjected the sample to fingerprint analysis for disposal approval; results of this analysis are included as Appendix E. The results indicated that the water contained concentrations of identifiable organic solvents that were greater than the hazardous waste identification criteria, and that the facility would characterize the water as a D-coded hazardous waste.

A total of 3,200 gallons of water was collected during the Phase II SI and shipped to the disposal facility on January 11, 1993. The waste was shipped under the U.S. EPA identification number (IN084259951), initiated for the site during the emergency removal actions. Appendix E also provides copies of the documentation for the water disposal.

In addition to the analyses of groundwater for its disposal, a sample of the discharge from the pumping test of CP-TP-01 was collected during the pumping period. This sample, CP-TP-01, and a trip blank, were sent to Lancaster Laboratories, Inc. for analysis. The analysis of CP-TP-01 included the cleanup criteria parameters listed in Table 3-1 of Exhibit A of the draft Consent Decree. The analysis was intended for direct comparison to these cleanup criteria. The analytical results are presented in Table 3 along with the cleanup criteria listed in Table 3-1.

The analytical results from the sample CP-TP-01 indicate that the acceptable subsurface water criteria are exceeded for nearly all the volatile organic compounds (VOCs), for two of the semivolatile organic compounds (semi-VOCs), and polychlorinated biphenyls (PCBs). None of the subsurface water criteria were exceeded for the inorganic parameters.

Sample CP-TP-01 was reported to contain 64,108 parts per billion (ppb) total VOCs and 766 ppb total semi-VOCs. Several of the identified VOCs and semi-VOCs are not included on Table 3-1. These compounds include: vinyl chloride, chloroethane, trichlorofluoromethane, 1,2-dichloroethane, 1,2-dichloroethene, 2,4-dimethylphenol, 1,2-dichlorobenzene, dimethylphthalate, and butyl benzylphthalate. Of these compounds, 1,2-dichloroethene, 1,2-dichloroethane, and vinyl chloride have Federal Maximum Contaminant Levels (MCLs). The reported concentrations of these additional VOCs that have MCLs have exceeded their respective MCL concentrations in sample CP-TP-01. Appendix F presents the raw laboratory data for the sample and the trip blank.

4

4.0 CONCLUSIONS

The objectives of the Phase II SI were stated in Section 2.1 as follows:

- To more accurately estimate the volume of stored groundwater and the maintenance dewatering rate that may be necessary to operate the proposed SVES.

- To assess the hydraulic interconnection between the upper till unit and the sand and gravel unit.

- To determine the feasibility of dewatering through trenches similar to the pilot study soil vapor extraction trenches.

- To evaluate the physical stability of an open trench excavation.

As previously indicated, one of the goals of this investigation was to quantify the volume of stored subsurface water. In order to provide a basis of calculation a datum of 9 feet below ground surface was chosen.

The Phase II SI identified significantly different subsurface conditions between Area C (the concrete pad area) and Areas A and B. Areas A and B were separated based on existing data from the Site RI and field screening data from the Phase II SI that suggest the vertical extent of contamination may be deeper in Area B than in Area A (the area north of the concrete pad). The calculations also show that the amount of stored groundwater is less in Areas A and B than in Area C. The conclusions regarding each of the Phase II SI objectives are addressed separately for each area because of these conditions.

4.1 Dewatering Calculations - Area A

The preliminary dewatering calculations presented in the Phase I SI Report (AWD, October 1992) treated the entire remedial boundary as having the same hydrogeological conditions. This was based on the data available at the time including the water levels measured in the concrete pad piezometers and the SVES standpipes during the Phase I SI. These preliminary calculations used a uniform depth of saturation and a single effective porosity to calculate the volume of water stored in the upper 9 feet of soil, and a uniform hydraulic conductivity to calculate the maintenance dewatering rate from the proposed SVES trenches.

The results of the Phase II SI suggest that the remedial boundary area should be separated into three sections based on the differences identified in subsurface conditions and vertical extent of contamination. These sections have been designated Area A, Area B, and Area C. Figure 3 presents the delineation of Areas A, B, and C, and the approximate surface area of each section. The dewatering calculations are presented in Appendix G. The areas have the following surface areas:

- Area A - 83,424 square feet
- Area B - 18,600 square feet
- Area C - 31,318 square feet

4.1.1 Stored Water Volume - Area A

Area A has a surface area of 83,424 square feet. The results of the Phase II SI indicate that saturation of the soil occurs at a depth of 5 feet BGS or greater even though little free groundwater was encountered above 9 feet BGS north of the concrete pad. The 10 percent effective porosity, as used in the Phase I SI (AWD, October 1992) and the Site RI (CH2M Hill, 1986), is still considered valid for the till encountered north of the concrete pad above 9 feet BGS because the encountered fine-grained sediment in this area was as previously described. Based on this information, the estimated volume of stored water in the sediment above 9 feet BGS in Area A is approximately 250,000 gallons. This volume will fluctuate as the depth of soil saturation changes; however, seasonal fluctuation is expected to occur slowly because of the soil cap and the low permeability of the soil.

4.1.2 Maintenance Dewatering Rate - Area A

Calculation of the maintenance dewatering rate for Area A down to a depth of 9 feet has changed from the calculations for that area from the Phase I SI (AWD, October 1992). The saturated thickness has been decreased from 12 feet to 10 feet based on the depth to saturation and the top of the sand and gravel unit as identified during the Phase II SI. In addition, the steady state or maintenance dewatering rate was calculated by assuming only inflow from the remedial boundary in each area. The required cap was assumed to limit local recharge; therefore, once the stored water was removed, the flow under the cap would approach zero.

The hydraulic conductivity of the upper 9 feet of soil (glacial till) used for the area north of the concrete pad is the same as that used for the "till" as used in the Phase I SI (AWD, October 1992) and the Site RI (CH2M Hill, March 1986). The dewatering calculations employed for Area A address only horizontal flow out of the fine grained sediment, and do not address the potential upward seepage from the sand and gravel unit after the dewatering of the shallow sediment. The fact that little free groundwater was encountered in Area A above 9 feet BGS and the existence of 9 to 10 feet of overburden between the proposed depth of the trenches and the top of the sand and gravel unit, indicate that the sand and gravel unit will not have significant hydraulic effects on the SVES trenches north of the point where there is little, if any, free groundwater being discharged to the trenches. The estimated maintenance dewatering rate for Area A is approximately 1.1 gpm.

4.1.3 Dewatering Trench Feasibility - Area A

Dewatering from the trenches at the 1.1 gpm estimate over 1,040 feet of "perimeter trench" (which equates to 0.001 gallons per minute per foot of trench) could require up to approximately 160 days (5 months) for the upper 9 feet of soil through gravity discharge (Appendix G). The operation of the SVE system may speed the process, even though dewatering to a depth of 9 feet may not be necessary in order to operate the SVE system in the area of soil contamination which is essentially limited to the upper 5 feet.

4.1.4 Trench Stability - Area A

The results of the Phase II SI excavation within Area A indicate that trench excavations would be stable down to 9 feet during the initial phase of excavation. Appendix A provides photographs showing the stable side walls of Test Pits DT-TP-01 and DT-TP-02.

4.2 Dewatering Calculations - Area B

The hydraulic parameters used for the calculations in Area A are the same for Area B.

4.2.1 Stored Water Volume - Area B

Area B has a surface area of 18,600 square feet. The results of the Phase II SI indicate that saturation of the soil occurs at a depth of 5 feet BGS or greater even though little free groundwater was encountered above 9 feet BGS north of the concrete pad. The 10 percent effective porosity, as used in the Phase I SI (AWD, October 1992) and the Site RI (CH2M Hill, 1986), is still considered valid for the impermeable till encountered north of the concrete pad above 9 feet BGS because the encountered fine-grained sediment in this area was as previously described. Based on this information, the estimated volume of stored water in the sediment above 9 feet BGS is approximately 55,650 gallons.

4.2.2 Maintenance Dewatering Rate - Area B

Similarly to Area A, the dewatering calculations employed for Area B address only horizontal flow out of the fine grained sediment, and do not address the potential upward seepage from the sand and gravel unit after the dewatering of the shallow sediment. The fact that little free groundwater was also encountered in Area B above 9 feet BGS and the existence of 9 to 10 feet of overburden between the proposed depth of the trenches and the top of the sand and gravel unit, indicate that the sand and gravel unit will not have significant hydraulic effects on the SVES trenches north of the point where there is little, if any, free groundwater being discharged to the trenches. The estimated maintenance dewatering rate for Area B is approximately 0.3 gpm.

4.2.3 Dewatering Trench Feasibility - Area B

Dewatering from the trenches at the 0.3 gpm estimate over 308 feet of trench (which equates to 0.001 gallons per minute per foot of trench) could require up to approximately 160 days (5 months) for the upper 9 feet of soil through gravity discharge, as required in Area A (Appendix G).

4.2.4 Trench Stability - Area B

The results of the Phase II SI excavation within Area B indicate that trench excavations would be stable down to 9 feet during the initial phase of excavation. Appendix A provides photographs showing the stable side walls of Test Pits DT-TP-03 and DT-TP-04.

4.3 Dewatering Calculations - Area C

Significantly different subsurface conditions were encountered in Area C as compared to Areas A and B. These conditions warranted the use of different hydraulic parameters as explained in the following sections.

4.3.1 Stored Water Volume - Area C

Area C has a surface area of approximately 31,318 square feet. The results of the Phase II SI indicate that saturation of the soil occurs at a depth of approximately 1.5 feet BGS as measured from the surface of the pad, although this saturation level may be largely the result of the gravel base under the pad, or hydraulic connection to the underlying sand and gravel aquifer through the EPA sump, and/or Monitoring Well 12. For the calculation of the initial volume of stored water, the saturated thickness was separated into two subthicknesses: the thickness of the gravel subbase (1.5 feet), and the remaining 6.0 feet thickness of the soil beneath the gravel subbase to a depth of 9 feet BGS. This separation allows the use of 30 percent effective porosity to be used for the gravel (as used by the U.S. EPA for the emergency removal action (Simes, June 1988) and 10 percent effective porosity for the remaining sediment (as used in the Phase I SI Report and the Site RI). Based on this information, the estimated initial volume of stored water in the sediment to a depth of 9 feet BGS is approximately 246,000 gallons with approximately 106,000 of those gallons from the zone in the gravel subbase. The dewatering calculations for the concrete pad are also provided in Appendix G.

4.3.2 Maintenance Dewatering Rate - Area C

Calculation of the dewatering rate for Area C has changed from the Phase I SI based on the results of the Phase II SI. The saturated thickness has been increased slightly based on the depth to water and the top of the sand and gravel unit as inferred on Figure 2. The horizontal hydraulic conductivity has been increased by one order of magnitude to 1.0×10^{-4} centimeters per second (cm/sec). This increase resulted from the occurrence of multiple sand lenses within the upper 9 feet of soil beneath the pad and the existence of the gravel subbase. The sand and gravel unit may have a recharge effect on any SVES trenches that are excavated to 9 feet BGS under the pad.

The estimated dewatering rate for the concrete pad area incorporates both horizontal and vertical flow components based on the excavation and pumping test data. The horizontal flow component has been estimated to be approximately 2 gpm. The vertical flow component, as presented in Appendix G, was calculated using a vertical hydraulic conductivity (10^{-5} cm/sec) which is one order of magnitude less than the horizontal hydraulic conductivity (10^{-4} cm/sec). The vertical hydraulic conductivity chosen for the vertical leakage calculations is based on the standard practice that vertical conductivity (particularly in heterogeneous soils like glacial till) is at least one order of magnitude less than the horizontal conductivity.

With this value, the upward vertical seepage rate was calculated using two methodologies: a simplified two-dimensional flow net with flow only in a vertical plane, and a simplified adaptation of Darcy's Law. The first method estimated approximately 0.5 gpm and the second method estimated approximately 2 gpm. The second method was selected as more representative, assuming a conservative approach that incorporates the theory that the short-term pumping test results at CP-TR-01 are indicative of influence from the sand and gravel unit. Using the 2 gpm vertical flow estimate, the total estimated dewatering rate for Area C is approximately 4 gpm. The vertical flow estimate is very dependent on the actual vertical hydraulic conductivity, and the total flow would exponentially increase with like increases in the vertical hydraulic conductivity.

4.3.3 Dewatering Trench Feasibility - Area C

The pumping test data from CP-TP-01 again indicate that dewatering of the fine grained sediment will be a slow process. The horizontal flow estimate of 2 gpm over 584 feet of trench represents 0.003 gpm per foot of trench. The gravel subbase will more quickly dewater than the saturated fine-grained soil beneath it.

4.3.4 Trench Stability - Area C

The results of the Phase II SI excavation under the concrete pad indicate that trench excavations would be stable during the initial phase of excavation down to 7 feet BGS provided that construction dewatering is undertaken. If trenches are required below 7 feet below ground surface, the trench interval will need reinforcement prior to construction of the dewatering drains because of caving conditions. Appendix A presents photographs of conditions encountered under the concrete pad at CP-TP-01.

4.4 Recommendations

The identification of site conditions during the Phase II warrants a third supplemental investigation prior to completion of the remedial design. The Phase III SI will consist of:

- The work necessary to determine the vertical leakage component from the sand and gravel unit (if any) in Area C.

- Evaluation of the need to abandon the existing wells/piezometers/sump on the concrete pad.

- Characterization of the present groundwater quality of the sand and gravel unit in Areas B and C.

- Characterization of the present vertical distribution of contaminants in the soil within the northern portion of the site (Areas A and B).

A study of the water management system (collection and treatment) should be performed subsequent to the Phase III SI. This study will derive the most efficient and cost effective methodology to manage the water generated as the result of the remedial measures to be implemented. Both the Phase III SI and the study should be completed prior to preparation of the final remedial design.

4.4.1 Phase III Supplemental Investigation

The proposed elements of the Phase III SI will include:

- Excavation of a test pit to 9 feet BGS at the southern end of the concrete pad and the performance of a minimum 3-day, constant rate pumping test from that test pit. If significantly different hydrogeological conditions are encountered in this test pit as compared to CP-TP-01, the original test pit will be reexcavated, and the pumping test will be performed out of CP-TP-01 for a minimum of 3 days.

- Installation of a 4-inch diameter sand and gravel unit recovery well at the southern end of the concrete pad, adjacent to the shallow test pit. A second, minimum 3-day pumping test will be performed out of this well.

- Installation of several observation wells screened solely in the concrete pad gravel subbase, several observation wells screened solely in the upper glacial till (approximately 4 to 9 feet BGS), and one observation well screened in the sand and gravel unit. These wells will be located adjacent to the proposed test pit and sand and gravel unit recovery well, in Area C.

- Test borings will be drilled within the location of the former pond. The test borings that are drilled within the area understood to be the location of the former pond will also be used to confirm the depth to undisturbed soil in that area.

- Groundwater sampling and analysis of both the proposed observation wells and the existing OW-A and OW-B series wells. The analysis will consist of the target contaminants from Table 3-1 of Exhibit A and other parameters for the treatability portion of the recommended study.

- Surveying of the proposed observation points for incorporation onto the site base map and for data evaluation.

4.4.2 Abandonment of the "EPA Sump" and Well ECC-MW-12

In addition to the two primary recommendations, a third issue was evaluated through the Phase II SI. This third issue is the present function of the existing "EPA Sump" and Monitoring Well ECC-MW-12. The available data suggest that these structures hydraulically connect the concrete pad gravel subbase to the shallow fine-grained sediment (including the identified sand lenses) and the sand and gravel unit. It is recommended that these structures be properly abandoned during construction of the dewatering system to limit continued contaminant transport between these units and potential vertical leakage from the sand and gravel unit. This abandonment should not take place until after the Phase III SI because the proposed Phase III SI activities will determine the relative hydraulic interconnection that these structures provide in Area C.

5

5.0 REFERENCES

1. 1992 (December), Phase II Supplemental Investigation Work Plan - Enviro-Chem Superfund Site; AWD Technologies, Inc.

2. 1992 (October), Phase I Supplemental Investigation Summary Report - Enviro-Chem Superfund Site; AWD Technologies, Inc.

3. 1986 (March), Remedial Investigation Report ECC Site; CH2M Hill, Inc.

4. 1988 (June), On Scene Coordinator's Report CERCLA Removal Project Environmental Conservation and Chemical Corporation - Removal Dates April 18, 1985 - July 19, 1985; William W. Simes - Enforcement and Emergency Response Branch United States Environmental Protection Agency.

5. 1988 (July 8), Interim Final Report of Vapor Extraction Pilot Test; Environmental Resources Management - North Central, Inc. in Attachment No. 1 of Exhibit A of the draft Site Consent Decree.

FIGURES

FIGURES

SDMS US EPA REGION V
FORMAT- OVERSIZED - 5
IMAGERY INSERT FORM

The item(s) listed below are not available in SDMS. In order to view original document or document pages, contact the Superfund Records Center.

SITE NAME	**ENVIROCHEM CORP**		
DOC ID #	**151773**		
DESCRIPTION OF ITEM(S)	**OVERSIZE SITE MAP**		
REASON WHY UNSCANNABLE	**_X_OVERSIZED**	**OR**	**___ FORMAT**
DATE OF ITEM(S)			
NO. OF ITEMS	**2**		
PHASE	**REM**		
PRP			
PHASE (AR DOCUMENTS ONLY)	**___ Remedial ___ Removal ___ Deletion Docket ___ AR ___ Original ___ Update # ___ Volume ___ of ___**		
O.U.			
LOCATION	**Box # 1 Folder # 3 Subsection _____**		
COMMENT(S)			
PARTIAL COPY OF OVERSIZED SITE MAP			

LEGEND

ISTING MONITORING WELL

ISTING PIEZOMETER

ASE II SITE INVESTIGATION TEST PIT

ASE II SITE INVESTIGATION OBSERVATION PIEZOMETER

OLOGIC CROSS SECTION LOCATION

ISSUED
APR 1 1993

PHASE II SITE INVESTIGATION
LOCATION OF TEST PITS, OBSERVATION PIEZOMETERS, AND SITE CROSS SECTION A-A'

ENVIRO-CHEM SUPERFUND SITE ZIONSVILLE, IN

...NT:	ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST	JOB NO.	2259-820	
SCALE	AS SHOWN	FIGURE NUMBER	1	REV 0

gravel unit should be found.

MW-12 not in this unit
(see SB-01, 02)

864

862

860

ISSUED
APR 1 1993

IC.

PHASE II SITE INVESTIGATION

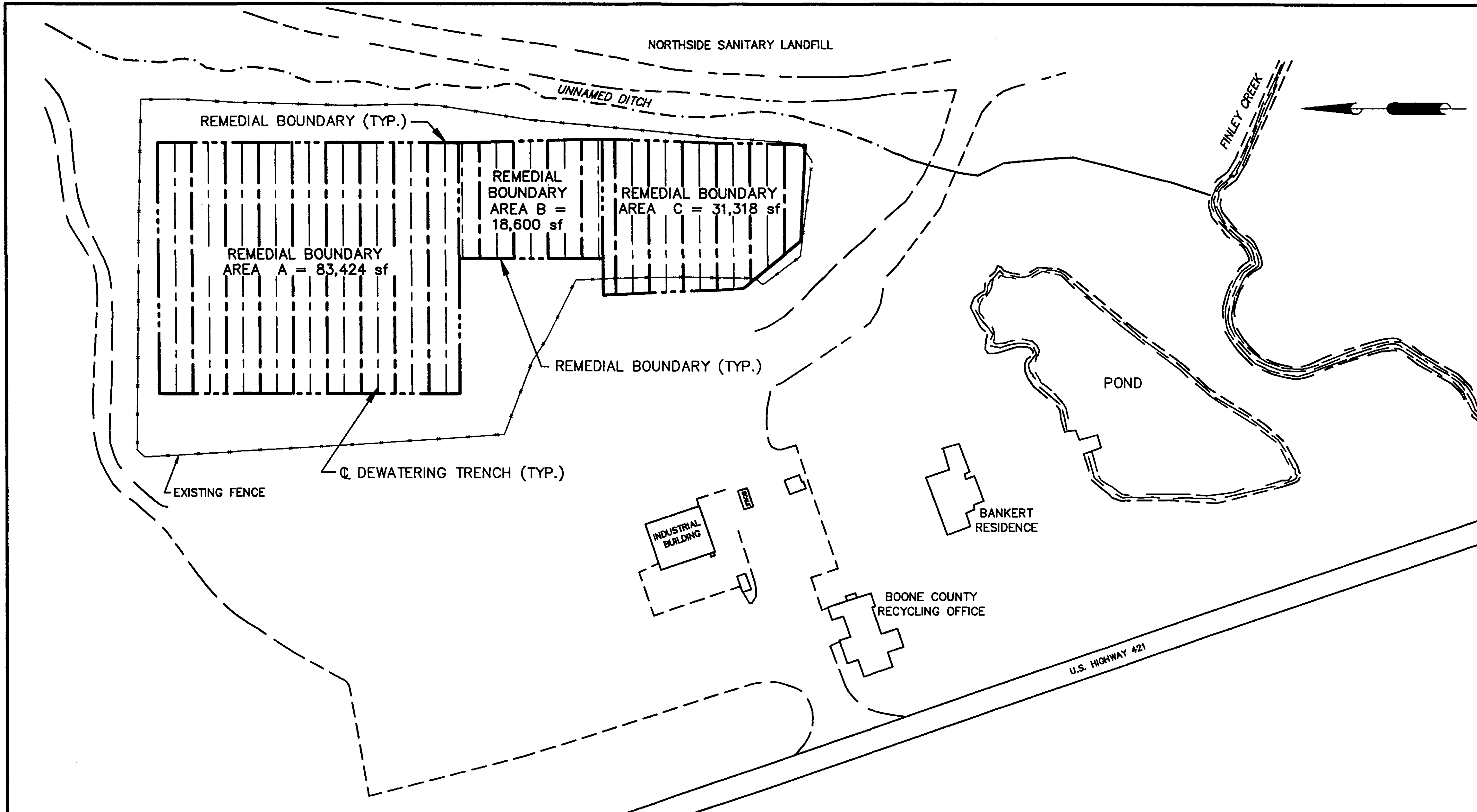
CROSS SECTION A – A'

ENVIRO–CHEM SUPERFUND SITE ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORPORATION TRUST	JOB NO. 2257–820

SCALE: AS SHOWN	FIGURE NUMBER 2	REV 0

[redacted]



AWD TECHNOLOGIES, INC.

AWD TECHNOLOGIES

REMEDIAL ACTION AREAS FOR DEWATERING CALCULATIONS

ENVIRO–CHEM SUPERFUND SITE — ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST — JOB NUMBER: 2259–820

SCALE: AS SHOWN — FIGURE NUMBER 3 — REV 0

032493RTH 092492GW

FILE: \ECC\CALCU

TABLES

TABLE 1

PHASE II SUPPLEMENTAL INVESTIGATION
TEST PIT AND OBSERVATION WELL LOCATION SUMMARY

Location	Ground Surface Elevation	Total Depth	Top of Casing Elevation	Screen Depth	Screen Elevation
CP-TP-01	884.20	9.5	-	-	-
DT-TP-01	887.15	9.0	-	-	-
DT-TP-02	887.05	14.0	-	-	-
DT-TP-03	886.52	11.5	-	-	-
DT-TP-04	887.75	15.0	-	-	-
OW-1A	885.98	9.5	887.37	4.0 - 9.0	881.98 - 876.98
OW-1B	885.95	24.0	886.67	18.0 - 23.0	867.95 - 862.95
OW-2A	887.25	9.5	889.22	4.0 - 9.0	883.25 - 878.25
OW-2B	887.15	24.5	888.55	19.0 - 24.0	868.15 - 863.15

TABLE 2

WATER LEVEL MEASUREMENT SUMMARY
PAGE 1 OF 2

Well No.	Ground Surface Elevation[3]	Top of Casing Elevation[4]	Height of Stick-up	September 16, 1992[1] Water Level Top of Casing	September 16, 1992[1] Water Level Below Ground Surface	September 16, 1992[1] Water Level Elevation[5]	January 8, 1993[2] Water Level Top of Casing	January 8, 1993[2] Water Level Below Ground Surface	January 8, 1993[2] Water Level Elevation[5]	February 3, 1993[6] Water Level Top of Casing	February 3, 1993[6] Water Level Below Ground Surface	February 3, 1993[6] Water Level Elevation[5]
PZ-1	885	885.4	0.4	1.40	1.00	884	1.14	0.74	884.3	1.62	1.22	883.8
PZ-2	885	885.4	0.4	1.79	1.39	883.6	1.68	1.28	883.7	1.76	1.36	883.6
PZ-3	884.5	885.1	0.6	2.15	1.55	883	1.99	1.39	883.1	2.00	1.40	883.1
PZ-4	884.5	884.8	0.3	1.35	1.05	883.5	1.14	0.84	883.6	NM	NM	NM
PZ-5	884.5	885.3	0.8	1.77	0.97	883.5	1.67	0.87	883.6	1.64	0.84	883.6
PZ-6	884	884	0.0	1.04	1.04	883	0.86	0.86	883.1	0.60	0.60	883.4
PZ-7	883.7	884	0.3	0.97	0.67	883	0.81	0.51	883.1	0.90	0.60	883.1
PZ-8	883.7	884	0.3	0.91	0.61	883	0.71	0.41	883.2	0.73	0.43	883.3
ECC-MW-8A	884.5	884.5	0.5	5.75	5.75	878.8	4.40	4.40	880.1	4.80	4.30	880.2
ECC-MW-12	883.3	885.5	2.2	2.45	0.35	883.1	2.26	0.16	883.2	1.91	+0.29	883.6
ECC-MW-11A	884.4	886.5	2.1	5.52	3.42	879.68	NM	NM	NM	5.42	3.32	881.1
SVES-1A	887.9	893.9	6.0	8.21	2.21	885.7	6.35	0.35	887.6	7.08	1.08	886.8
SVES-1B	887.9	891.7	3.8	6.06	2.31	885.6	4.20	0.45	887.5	4.94	1.14	886.8

TABLE 2

WATER LEVEL MEASUREMENT SUMMARY
PAGE 2 OF 2

Well No.	Ground Surface Elevation[3]	Top of Casing Elevation[4]	Height of Stick-up	September 16, 1992[1]			January 8, 1993[2]			February 3, 1993[6]		
				Water Level Top of Casing	Water Level Below Ground Surface	Water Level Elevation[5]	Water Level Top of Casing	Water Level Below Ground Surface	Water Level Elevation[5]	Water Level Top of Casing	Water Level Below Ground Surface	Water Level Elevation[5]
SVES-2A	887.9	893.6	5.7	6.95	1.25	886.7	5.81	0.11	887.8	6.56	0.86	887.0
SVES-2B	887.9	892.4	4.5	5.82	1.32	886.6	4.69	0.19	887.7	5.42	0.92	886.9
OW-1A	885.98	887.37	1.39	-	-	-	9.26	7.87	878.11	7.86	6.47	879.51
OW-1B	885.95	886.67	0.72	-	-	-	5.80	5.08	880.87	5.91	5.19	880.76
OW-2A	887.25	889.22	1.97	-	-	-	Dry	Dry	-	7.38	5.41	881.84
OW-2B	887.15	888.55	1.40	-	-	-	7.06	5.66	881.49	7.20	5.80	881.35

Notes

(1) Measurements from the Phase I Supplemental Investigation.
(2) Measurements from the Phase II Supplemental Investigation on January 8, 1993 except for OW-1A, OW-1B, OW-2A, and OW-2B which were measured on January 11, 1993.
(3) All ground surface elevations are inferred from the site topographic map except OW-1A, OW-1B, OW-2A, and OW-2B which were surveyed on January 10, 1993.
(4) All top of casing elevations are approximate based on the inferred ground surface elevation and physical measurement of casing stick-up except OW-1A, OW-1B, OW-2A, and OW-2B which were surveyed on January 10, 1993.
(5) All water level elevations are approximate except for OW-1A, OW-1B, OW-2A, and OW-2B as explained in footnotes (3) and (4).
(6) Additional water level measurements from February 3, 1993.
NM Not Measured.

TABLE 3

GROUNDWATER ANALYTICAL RESULT COMPARISON

Compounds[1]	**Acceptable Subsurface Water Concentration[1] (μg/L)**	Acceptable Stream Concentration[1] (μg/L)	Acceptable Soil Concentration[1] (μg/kg)	ECC-MW-12[2] April 28, 1988 (μg/L)	CP-TP-01[3] January 10, 1993 (μg/L)
Volatile Organics (VOCs)					
Acetone	3,500 RB		490	**11,000**	<100
Chlorobenzene	60 MCLGP		10,100		<50 (BDL)
Chloroform	100 MCL	15.7	2,300	**5,300**	**430**
1,1-Dichloroethane	0.38 RB		5.7	**3,700**	**5,700**
1,1-Dichloroethene	7 MCL	1.85	120	-	**310**
Ethylbenzene	680 MCLGP	3,280	234,000		**470**
Methylene Chloride	4.7 RB	15.7	20	**12,000**	**1,200**
Methyl Ethyl Ketone	170 LDWHA		75		<100
Methyl Isobutyl Ketone	1,750 RB		8,900		<500
Tetrachloroethene	0.69 RB	8.85	130	**13,000**	71
Toluene	2,000 MCLGP	3,400	238,000	**7,200 J**	**2,200**
1,1,1-Trichloroethane	200 MCL	5,280	7,200	**64,000**	**14,000**
1,1,2-Trichloroethane	0.61 RB	41.8	22		120
Trichloroethene	5 MCL	80.7	240	**16,000**	**1,300**
Total Xylenes	440 MCLGP		195,000		**3,400**

TABLE 3

GROUNDWATER ANALYTICAL RESULT COMPARISON
PAGE 2 OF 4

Compounds[1]	**Acceptable Subsurface Water Concentration[1] (µg/L)**	Acceptable Stream Concentration[1] (µg/L)	Acceptable Soil Concentration[1] (µg/kg)	ECC-MW-12[2] April 28, 1988 (µg/L)	CP-TP-01[3] January 10, 1993 (µg/L)
Additional Volatile Organics					
Vinyl Chloride	NA	NA	NA	-	340
Chloroethane	NA	NA	NA	-	290
Trichlorofluoromethane	NA	NA	NA	-	100
1,2-Dichloroethene	NA	NA	NA	72,000	34,000
1,2-Dichloroethane	NA	NA	NA	-	67
Base Neutral/Acid Organics					
Bis(2-ethylhexyl)phthalate	2.5 RB	50,000		**49 B**	**27**
Di-n-Butyl Phthalate	3,500 RB	154,000		3 J	<10 (BDL)
Diethyl Phthalate	28,000 RB	52,100		130	400
Isophorone	8.5 RB			**120**	**55**
Naphthalene	14,000 RB	620		28	21
Phenol	1,400 RB	570	9,800		140

TABLE 3 GROUNDWATER ANALYTICAL RESULT COMPARISON PAGE 3 OF 4					
Compounds(1)	**Acceptable Subsurface Water Concentration(1) (μg/L)**	Acceptable Stream Concentration(1) (μg/L)	Acceptable Soil Concentration(1) (μg/kg)	ECC-MW-12(2) April 28, 1988 (μg/L)	CP-TP-01(3) January 10, 1993 (μg/L)
Additional Base Neutral/Acid Organics					
2,4-Dimethylphenol	NA	NA	NA	300	77
1,2-Dichlorobenzene	NA	NA	NA	67	21
Dimethyl Phthalate	NA	NA	NA	-	14
Butyl Benzyl Phthalate	NA	NA	NA	?	11
Inorganics					
Antimony	14 RB			-	5
Arsenic	50 MCL	0.0175		12	6
Barium	1,000 MCL			161	200
Beryllium	175 RB			-	<10 (BDL)
Cadmium	10 MCL			-	<10 (BDL)
Chromium VI	50 MCL	11		7 JB	<20 (BDL)
Lead	50 MCL	10		-	28
Manganese	7,000 RB			225	410
Nickel	150 LDWMA	100		16 J	<50 (BDL)
Silver	50 MCL			-	<20 (BDL)
Tin	21,000 RB			Not Analyzed (?)	<300 (BDL)
Vanadium	245 RB			-	<10 (BDL)

TABLE 3 GROUNDWATER ANALYTICAL RESULT COMPARISON PAGE 4 OF 4					
Compounds[1]	**Acceptable Subsurface Water Concentration[1] (μg/L)**	Acceptable Stream Concentration[1] (μg/L)	Acceptable Soil Concentration[1] (μg/kg)	ECC-MW-12[2] April 28, 1988 (μg/L)	CP-TP-01[3] January 10, 1993 (μg/L)
Zinc	7,000 RB	47		177 JB	50
Cyanide	154 LDWMA	5.2		(?)	6
Pesticides/PCBs					
PCBs	0.0045 RB	0.000079		(?)	**0.6**

Notes

(1) From Table 3-1 of the Consent Decree.
(2) Analytical results reproduced from Technical Memorandum No. 2, CH2M Hill.
(3) Analytical results from the groundwater discharge sample taken during the pumping test of CP-TP-01.
(4) "Additional VOCs and semi-VOCs" analyzed by Methods SW-8240 and SW-8270 are contaminants that were detected but do not appear on Table 3-1 of the Consent Decree.

APPENDIX A

PHASE II SI PHOTOGRAPHIC LOG

Photo No.: 1
Description: Concrete pad test pit area after sawing with concrete saw

Photo No.: 2
Description: Concrete pad test pit - first concrete slab being lifted by backhoe

Photo No.: 3
Description: Concrete pad test pit and soil stockpile area secured for night

Photo No.: 4
Description: Start of excavation of concrete pad test pit

Photo No.: 5
Description: Water flowing into concrete pad test pit from both the gravel subbase and the finer grained material beneath the gravel

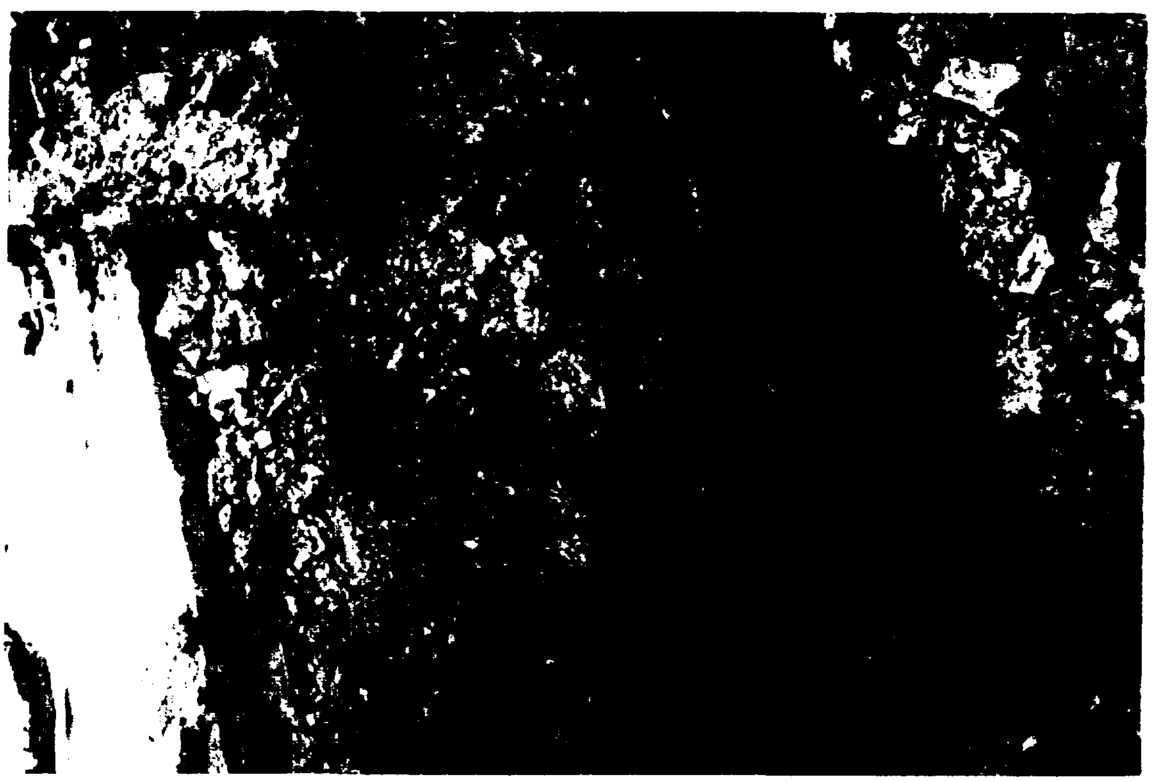


Photo No.: 6
Description: Same view as photo No. 5 - Note that recent rain had filled the gravel subbase and visible water flow was occurring from the contact between the gravel subbase and the underlying material during excavation

Photo No.: 7

Description: Concrete pad test pit at 4 foot in depth after 1 hour of downtime due to dewatering pump failure. The water level was approximately 2 feet beneath the pad surface

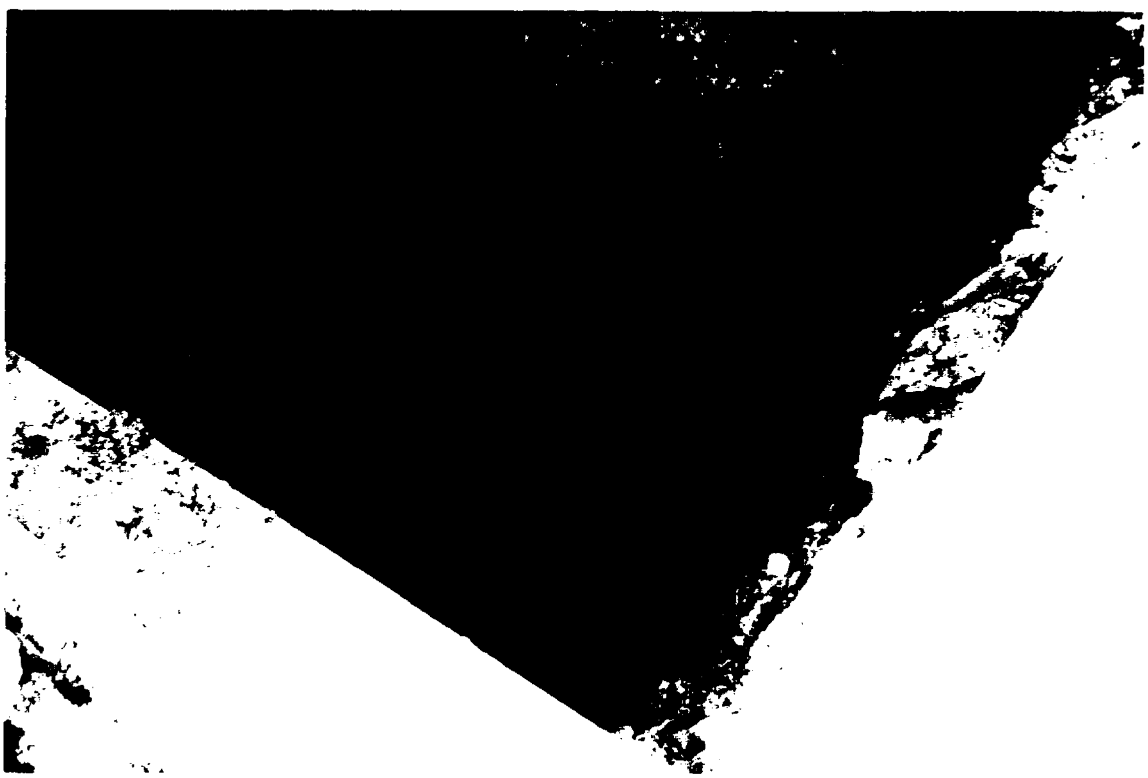


Photo No.: 8

Description: Concrete pad test pit at 4 foot in depth after dewatering with 2-inch pump

Photo No.: 9

Description: Start of excavation on DT-TP-01. The only water entering the hole at depth of 3 feet was from standing water (rain water) in the shallow soil.

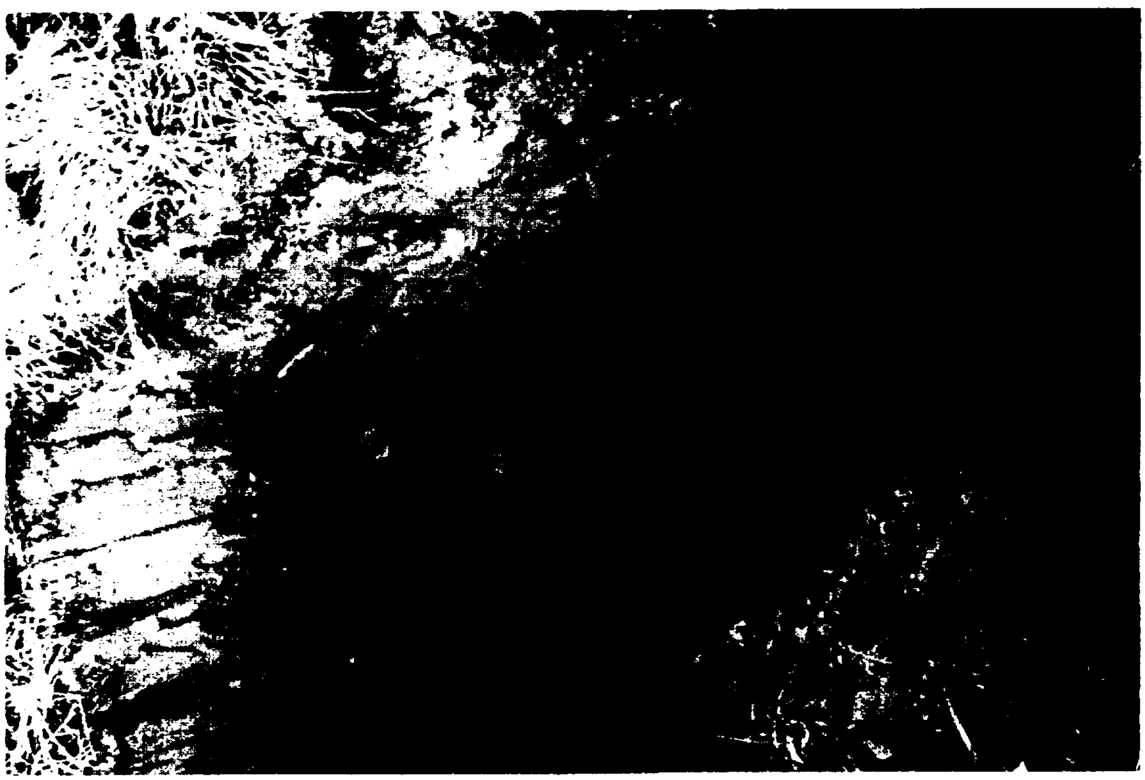


Photo No.: 10

Description: DT-TP-01 at 9 foot in depth. In center right of photo is an approximately 1 ft^2 area of groundwater seepage at 5 foot below ground surface. The seepage site was a fraction of a gallon per minute.

Photo No.: 11
Description: DT-TP-01 at start of day on 1-7-93. Water in the borehole is from drainage out of the near surface soils. Note the minor wall collapse around the seepage area noted in Photo No. 10.

Photo No.: 12
Description: Start of excavation of the originally planned dewatering trench - going eastward from DT-TP-01.

Photo No.: 13

Description: Stable sidewalls on the dewatering trench excavation. A portion of DT-TP-01 is off to the lower left side of the photo.

Photo No.: 14

Description: Center of photo - portion of old drainage pipe that apparently extended from the existing site building to the ditch north of the site. The pipe was filled with black sludge (headspace over 700 ppm). It was encountered at 2.5 ft below ground surface, 15 feet west of DT-TP-01 along the dewatering trench excavation.

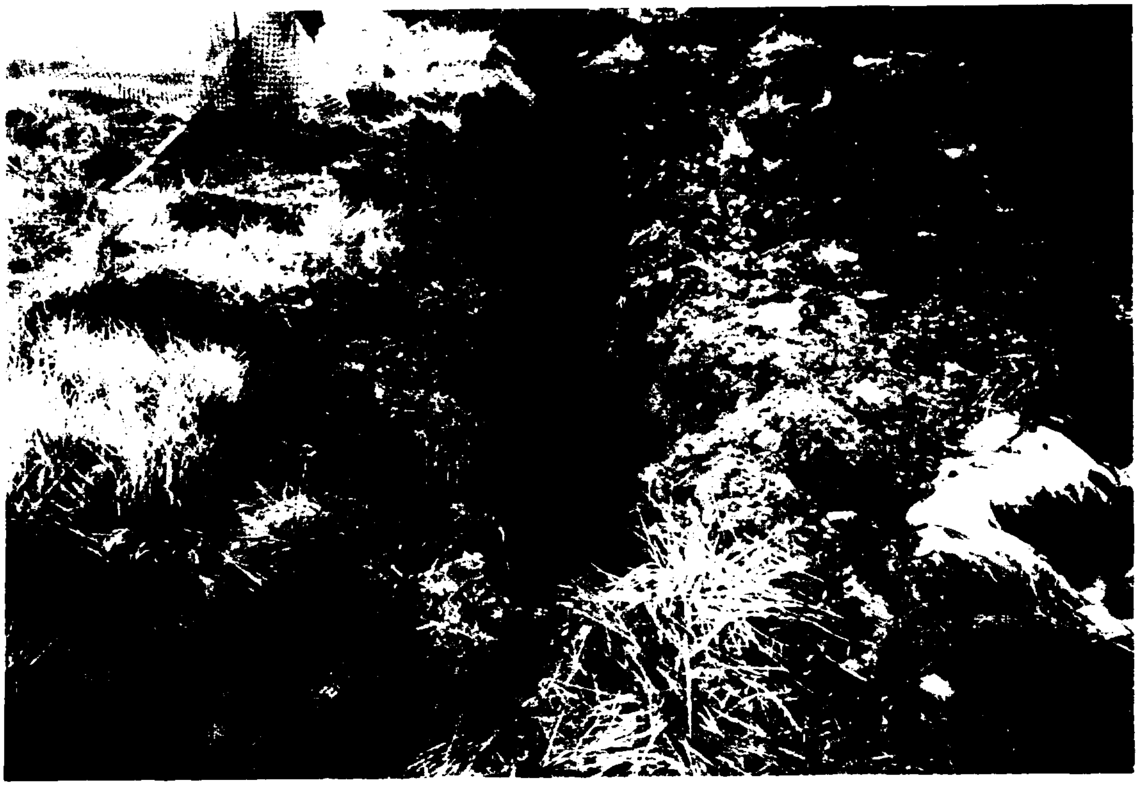


Photo No.: 15
Description: Full length view of the dewatering trench excavation. Note the stable sidewalls and very little groundwater inflow.

Photo No.: 16
Description: DT-TP-02 excavation to 6 feet in depth. Note the groundwater seepage from the gray to brown sand lens near base of the excavation.

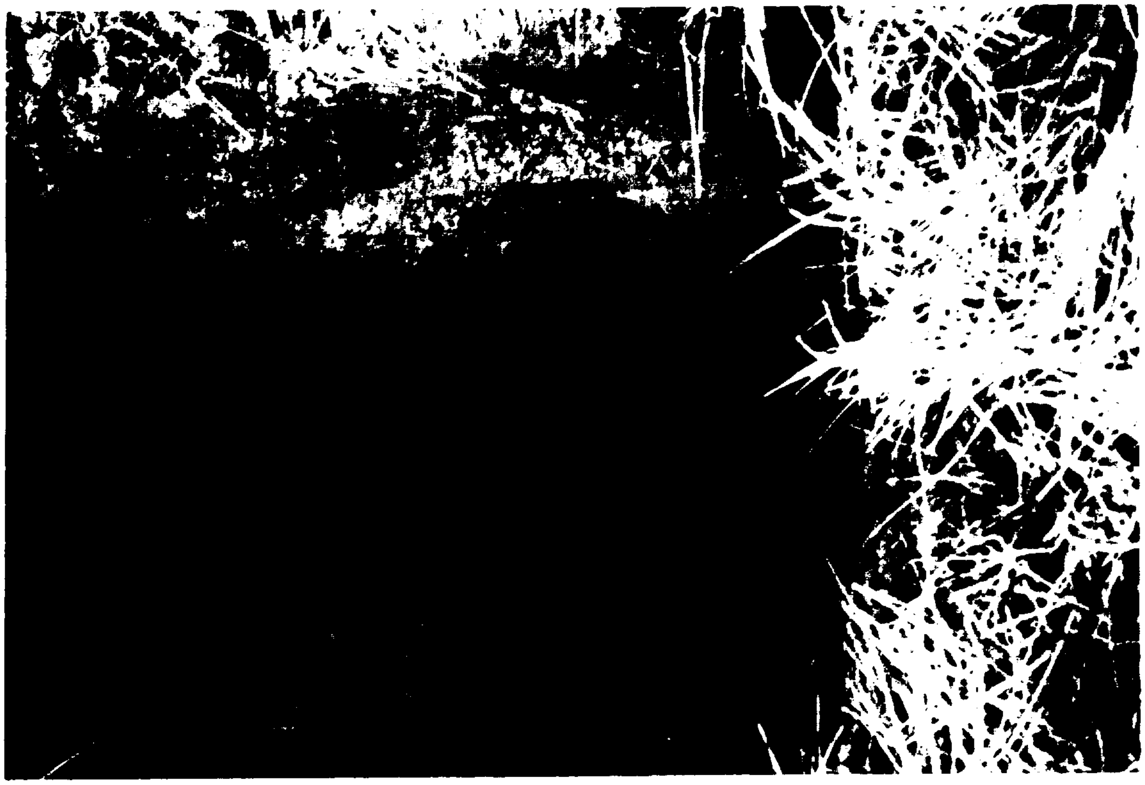


Photo No.: 17
Description: DT-TP-02 at 14 feet in depth. Water near top of photo was flowing in from the near surface soil. The sediment at the base of the pit was wet but very little (if any) free groundwater was entering the pit.

Photo No.: 18
Description: Groundwater entering DT-TP-03 at approximately 9.0 feet below ground surface.

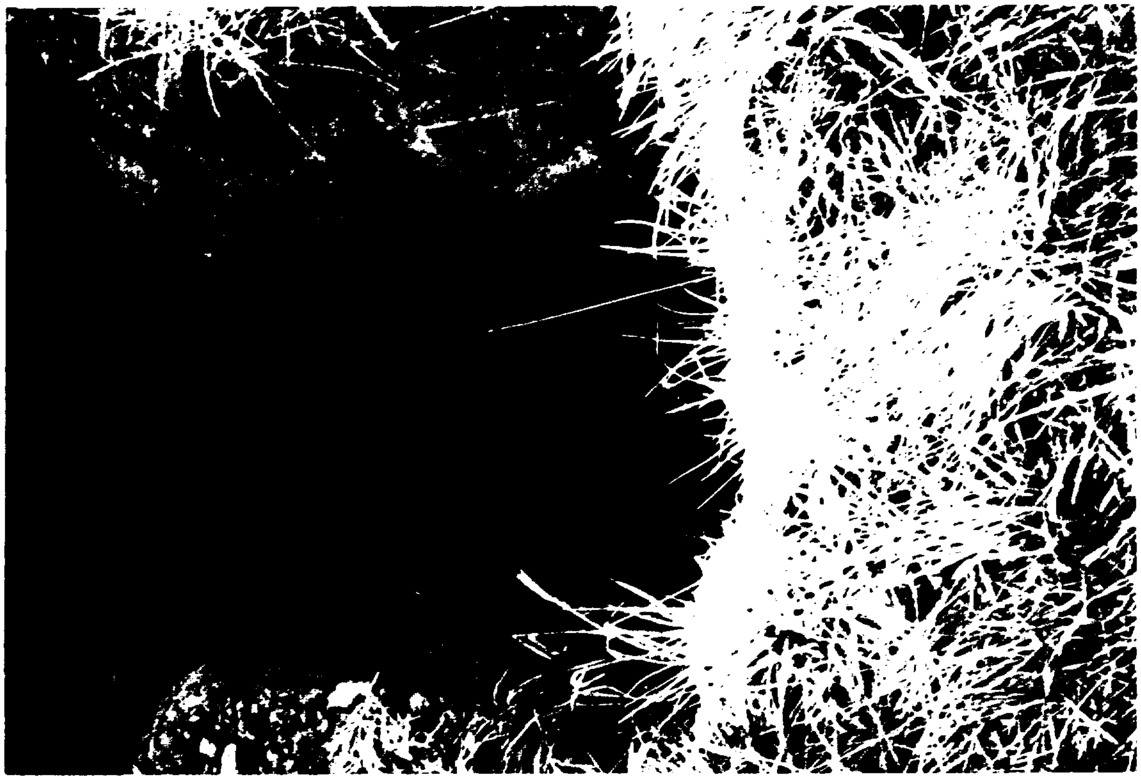


Photo No.: 19
Description: Overview of DT-TP-03 at 11.5 feet in depth. Note that minor groundwater (not measurable) was occurring at 4 foot below ground surface and water was running into the pit at approximately 9.0 to 9.5 feet below ground surface.

Photo No.: 20
Description: Start of excavation of DT-TP-04 at southeast end of present tank staging area.

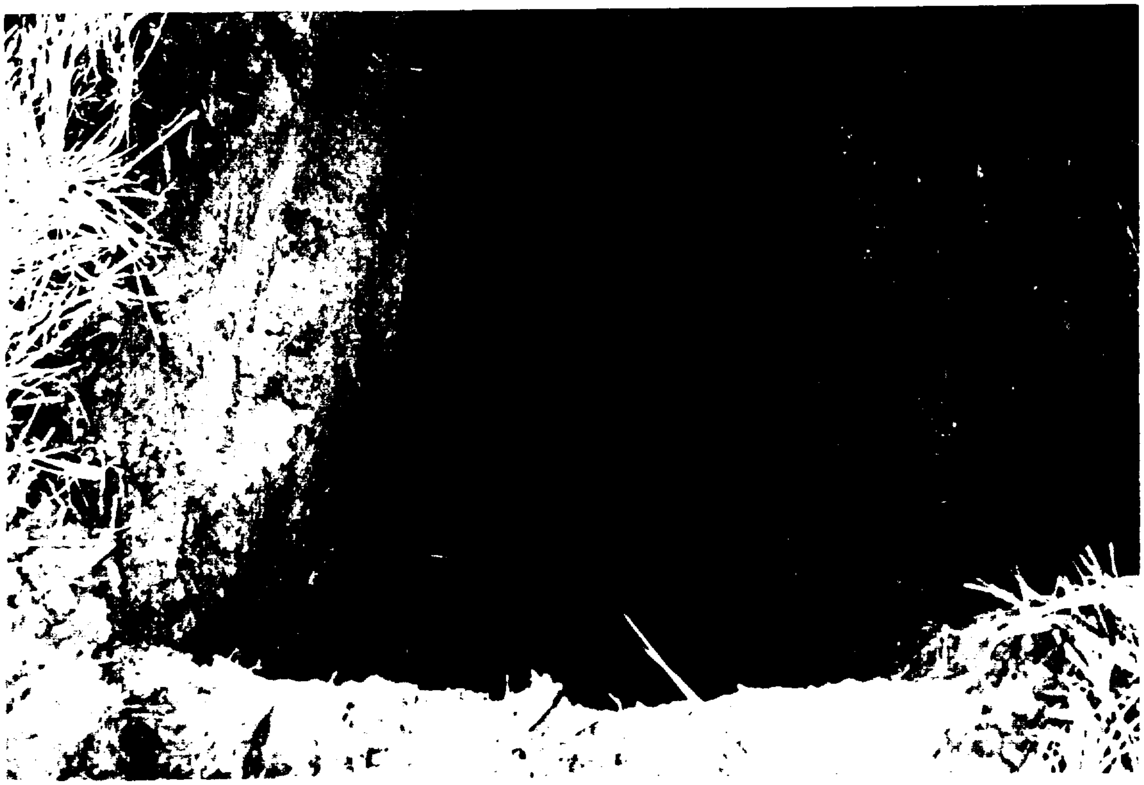


Photo No.: 21

Description: DT-TP-04 at 11 feet below ground surface. Hole was dry except for immeasurable seep at 10 foot below ground in southeast corner (upper right) of the test pit. Noticeable water at top of photo is coming from the gravel subbase of the adjacent site access road (between the pit and the A-frame building).

Photo No.: 22

Description: DT-TP-04 at 15 feet in depth. Sediment at 15 feet is wet but not yielding groundwater to the pit.

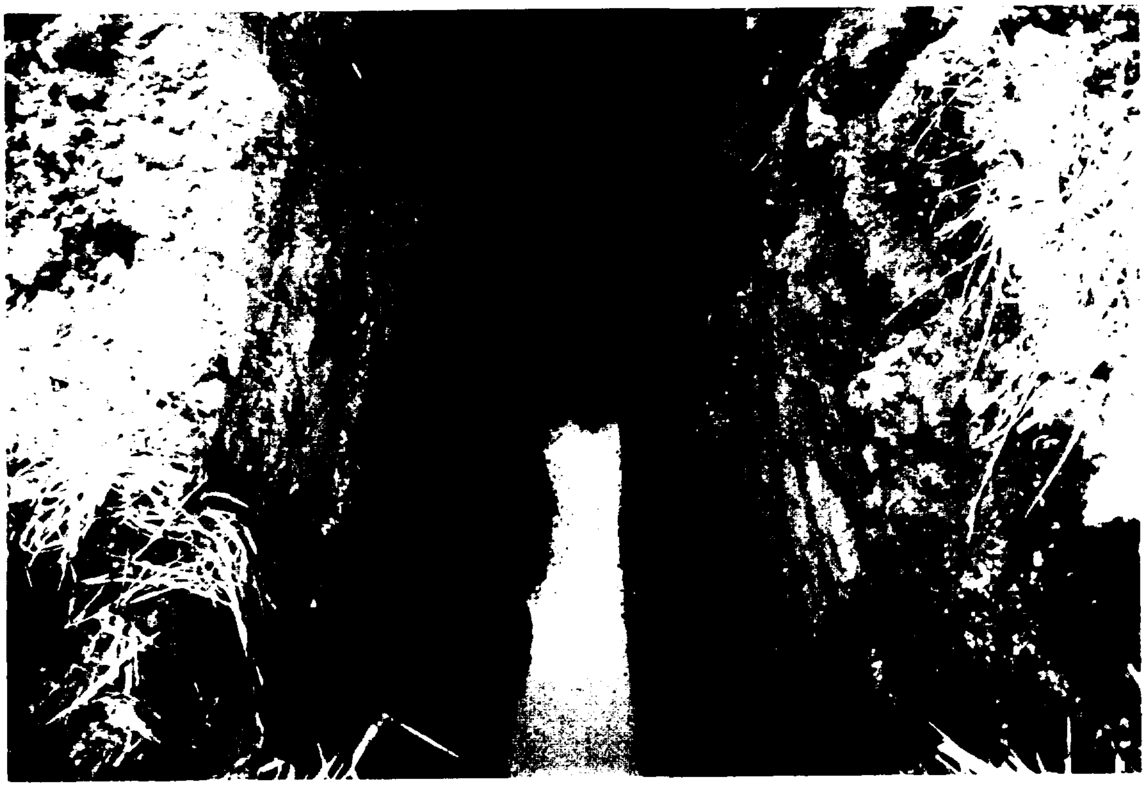


Photo No.: 23
Description: Accumulated groundwater in DT-TP-03 one day after finishing excavation. Water level was at 9 feet below ground surface at a pit depth of 11 feet.

Photo No.: 24
Description: Drilling of OW-1B showing drill rig, cuttings collection, and exclusion zone.

Photo No.: 25
Description: Overall view of concrete pad test pit area and water storage (frac) tank after snow accumulation on the night of 1-9-93.

Photo No.: 26
Description: Test pit on concrete pad prior to pumping set up on 1-10-93. Note that extremely cold and windy weather had frozen the surface of the water in the pit overnight.

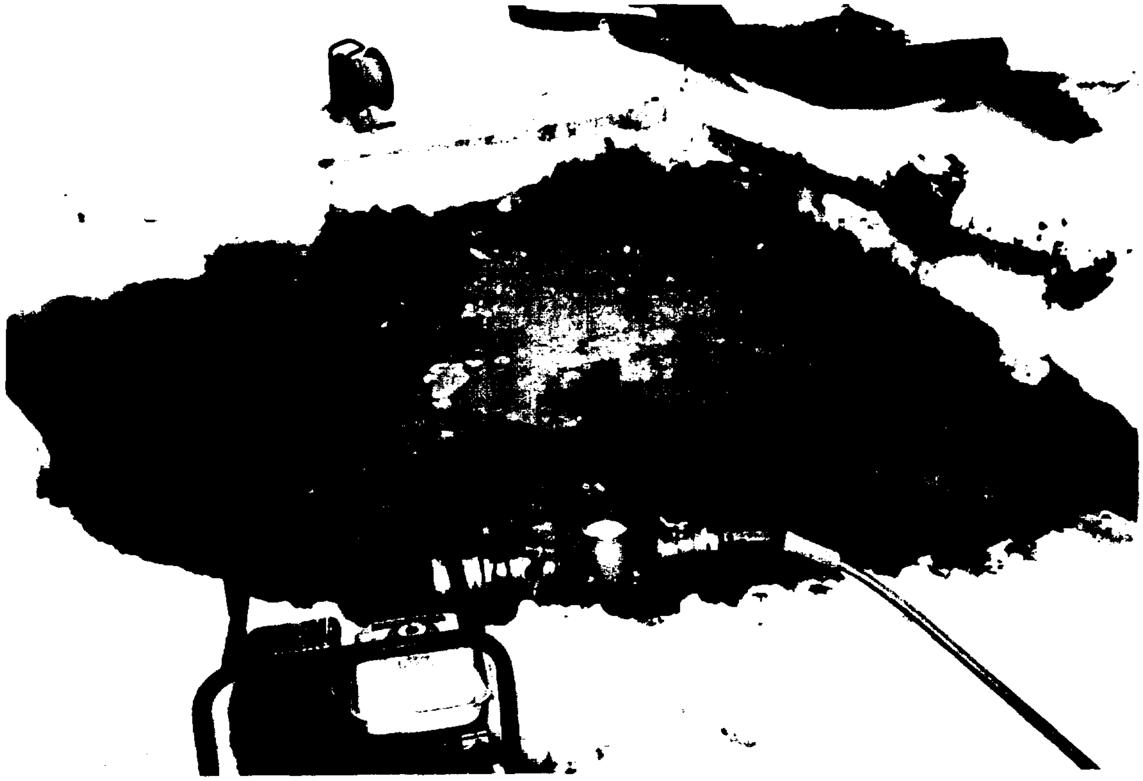


Photo No.: 27
Description: Concrete pad test pit after breaking ice cover and setting up pump/flow meter prior to pumping.

Photo No.: 28
Description: Water level in test pit after 70 minutes of pumping (25 minutes at 1.3 gpm and 35 minutes at 4.5 gpm). The total drawdown after removal of 250 gallons was approximately 0.32 feet. Note that the water level is still above the bottom of the gravel subbase.

Photo No.: 29
Description: Water level in test pit at 120 minutes of pumping. Water level near the base of the gravel subbase with very little water flowing out of the gravel.

Photo No.: 30
Description: Water level below gravel subbase. Oily sheen appearing on water coming from saturated sediment beneath the gravel.

Photo No.: 31
Description: Due to extremely cold weather and slow drawdown during pumping, the water level in the concrete pad test pit began to refreeze at approximately 17:00 (2.5 hours) into pumping.

Photo No.: 32
Description: Final photo of water level in the concrete pad test pit just before stoppage of pumping. Note the diffuse seepage of water out of the fine grained material beneath the gravel subbase.

APPENDIX B

TEST PIT AND OBSERVATION PIEZOMETER GEOLOGICAL LOGS

AWD TECHNOLOGIES

TEST PIT NO. OP-TP-#1 PAGE 1 OF 1

BY D. Ruggery
DATE 1-6-93
CHK BY
DATE

PROJECT NAME ECC Phase II SI
PROJECT NO. 2259-820
LOCATION Enviro Chem Site
GEOLOGIST D. Ruggery
EXCAVATION CONTRACTOR AWD, Tech
DRILLER Al Sandow
EXCAVATION START DATE 1-5-93
RIG TYPE
SURFACE ELEVATION
EXCAVATION COMPLETION DATE: 1-6-93

ON Concrete Pad 40' west of East fence 10' North of PZ-5

DEPTH FEET	SAMPLE NO.	LITHOLOGIC CLASSIFICATION	PROFILE	WATER BEARING ZONES	EST. FLOW (GPM)	OBSERVATIONS/ REMARKS
0		0.3 Unreinforced Concrete pad				• Test Pit 10'x10' surface area - had to cut Concrete with saw.
		gray angular cobbles; some silt, wet				
2		2.0				• Standing water at 1.5' BGS
	SS#3	- brown to gray silt and clay, some angular gravel, soft, (looks like fill) wet				• water flowing into pit from 1.5' to 4'. Most water flowing sheet flow from contact at 2' BGS
4						
		5.0				Construction dewatering greater than 5 gpm to keep hole dry.
6		- gray clay, little fine sand and small rounded gravel, wet (but noticeably drier than above)				
	SS#2					- At 7' BGS - small seepage area - water has oily sheen - less than 1 gpm
8						
	SS#3	grades to gray silt and fine sand, little clay				
10		9.5' = T.D.				
12						

ADDITIONAL REMARKS

Headspace: Soil Samples

SS#1 59.0 ppm
SS#2 0.0 ppm
SS#3 3.3 ppm

AWD TECHNOLOGIES

TEST PIT NO. DT-TP-#1

PAGE 1 OF 1

BY D. Ruggery
DATE 1/6/93
CHK BY
DATE

PROJECT NAME ECC-Phase II SI
LOCATION Enviro Chem Site
EXCAVATION CONTRACTOR AWD Tech
EXCAVATION START DATE 1-6-93
SURFACE ELEVATION
Test Pit 45' south of north fence line

PROJECT NO. 2259-820
GEOLOGIST D. Ruggery
DRILLER Al Sandow
RIG TYPE Case Backhoe
EXCAVATION COMPLETION DATE: 1-6-93

DEPTH FEET	SAMPLE NO.	LITHOLOGIC CLASSIFICATION	PROFILE	WATER BEARING ZONES	EST. FLOW (GPM)	OBSERVATIONS/ REMARKS
0		grass - heavy root zone - standing water from previous days rain				
		1.2				
		brown to orange silt and clay, hard, damp				
2		2.0				
	SS#1	brown silt, little gravel and fine sand, hard, damp				
4		4.5				
		gray silt, little fine sand and small gravel (< 1/4"), moist except at 5' small seepage area			<1	← 5.0' 1ft² seepage area; less than 1 gpm
6						
	SS#2					
8		Same as above no noticeable groundwater seepage				
	SS#3	TD' = 9.0'				
10						
12						

ADDITIONAL REMARKS

Headspace Soil Samples:

SS# 1	28.0	ppm
SS# 2	0.0	ppm
SS# 3	0.0	ppm

AWD TECHNOLOGIES

TEST PIT NO. DT-TP-#2

PAGE 1 OF 1

BY D. Ruggery

DATE 1/7/93

CHK BY

DATE

PROJECT NAME ECC-Phase II SI

LOCATION Enviro Chem Site

EXCAVATION CONTRACTOR AWD Technologies

EXCAVATION START DATE 1-7-93

SURFACE ELEVATION

PROJECT NO. 2259-820

GEOLOGIST D. Ruggery

DRILLER Al Sandow

RIG TYPE Case Backhoe

EXCAVATION COMPLETION DATE: 1-7-93

DEPTH FEET	SAMPLE NO.	LITHOLOGIC CLASSIFICATION	PROFILE	WATER BEARING ZONES	EST. FLOW (GPM)	OBSERVATIONS/ REMARKS
0		grass - heavy root zone standing water, seepage from recent rain				
		1.2				
		brown to orange silt and clay, hard, damp				
2		2.0				
		brown silt, little gravel and fine sand, hard, damp				
4		4.0				
		red-brown silt and fine sand, moist				
6		6.0				
		gray to brown coarse sand, wet				
		6.5				
		gray silt, little fine sand and rock frags, moist				this zone is softer than gray silt at TP-#1
8						
10						
		11.0				
		- gray fine to coarse sand, some silt, wet				
		11.5				
12		- gray silt, little fine sand, very hard				
14	SS#1	T.D. = 14.0' same as above				14.0 ft was max depth of backhoe

ADDITIONAL REMARKS

Headspace Meas SS#1 Hnu 0.0ppm Depth 14'bgs

AWD TECHNOLOGIES

TEST PIT NO. OT-TP-#3 **PAGE** 1 **OF** 1

BY: D. Ruggery	PROJECT NAME: ECC Phase II SI
DATE: 1-7-93	PROJECT NO.: 2259-820
CHK BY:	LOCATION: Enviro Chem Site
DATE:	GEOLOGIST: D. Ruggery
	EXCAVATION CONTRACTOR: AWD Technologies
	DRILLER: Al Sandow
	EXCAVATION START DATE: 1-7-93
	RIG TYPE: Case Backhoe
	SURFACE ELEVATION:
	EXCAVATION COMPLETION DATE: 1-7-93

10' North of Concrete Pad north of soil berm

DEPTH FEET	SAMPLE NO.	LITHOLOGIC CLASSIFICATION	PROFILE	WATER BEARING ZONES	EST. FLOW (GPM)	OBSERVATIONS/ REMARKS
0		Brown to orangish brown silt, little clay and trace of of rock frags / man-made debris (Fill) damp				
2						
4	SS#1	4.0				
		gray silt, little clay and rock frags, moist, soft				After hole open for 2 hours - slight seepage from contact at 4'
6						very contaminated Head space at hole > 400 ppm
	SS#2					
8						
		9.0				
	SS#3	brown fine to coarse sand, little silt, wet				water running into hole 1-2 gpm
10						Continued high head space
		11.0				
		-(Back to) gray silt as above (moist)				
12		T.D. = 11.5'				

ADDITIONAL REMARKS

Soil Sample Headspace

Sample #	HNU
SS#1	608 ppm
SS#2	105.7 ppm
SS#3	163.6 ppm

AWD TECHNOLOGIES

TEST PIT NO. DT-TY-#4 PAGE 1 OF 1

BY: D. Ruggery	PROJECT NAME: ECC Phase II SI
DATE: 1-9-93	PROJECT NO.: 2259-[illegible]
CHK BY:	LOCATION: Enviro Chem Site
DATE:	GEOLOGIST: D. Ruggery
	EXCAVATION CONTRACTOR:
	DRILLER: Al [illegible]andow
	EXCAVATION START DATE: 1-7-93
	RIG TYPE: Case Backhoe
	SURFACE ELEVATION:
	EXCAVATION COMPLETION DATE: 1-7-93

15' SSW of Tank Farm Area (on west side of old road)

DEPTH FEET	SAMPLE NO.	LITHOLOGIC CLASSIFICATION	PROFILE	WATER BEARING ZONES	EST. FLOW (GPM)	OBSERVATIONS/ REMARKS
0		root zone - decaying grass				
1		1.0				
2		orange brown silt, little fine sand, clay, and rock frags, moist				
4	SS#1	4.0				
		at 5' same as above except more clay, wet				sediment wet but no water entering hole
6						
8		8.0 grades to gray silt, little rock fragments, moist				
	SS#2					
10						small seep (<1 ft?) at 10' BGS [illegible] corner of pit
12						
		grades to gray silt and clay, wet				sediment wet but not yielding water to pit
14	SS#3	T.D. = 15' BGS				

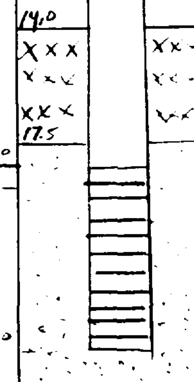
ADDITIONAL REMARKS: Pit dug to maximum depth of backhoe

AWD TECHNOLOGIES

WELL NO. OW-1B | **PAGE** 1 **OF** 1

BY D. Ruggery	PROJECT NAME ECC Phase II SI		PROJECT NO. 2257-320
DATE 1-9-93	LOCATION Enviro-Chem Site	GEOLOGIST D. Ruggery	
CHK BY	DRILLING CONTRACTOR Reynolds, Inc.	DRILLER Danny Allen	
DATE	DRILLING METHOD 6 1/4" Hollow Stem Augers	RIG TYPE Mobile Drill B-53	
	DRILLING START DATE 1-8-93	DRILLING COMPLETION DATE 1-9-93	
	SURFACE ELEVATION	STICK-UP ELEVATION	

DEPTH FEET	SOIL SAMPLE NO.	REC. (IN.)	BL./6"	ROCK SAMPLE RUN (FT)	REC. (%)	RQD. (%)	VISUAL CLASSIFICATION AND REMARKS	PROFILE	STATIC WATER LEVEL (FT)	BORING/CASING DIA. (IN.)	DEPTH (FEET)	WELL CONSTRUCTION DETAILS	REMARKS
0							brown to grayish brown silt, little clay and trace of rock fragments						
5													
	SS #1	12	2 5 6 15				6.5						
7							brown fine to coarse sand, wet						this zone yielded water at OT-TP-#3
	SS #2	18	2 2 10 10				7.3 gray silt, little clay and fine sand, moist						very little water in borehole
9													
10													
15													
	SS #3	8	4 4 6 8				gray silt and clay, soft, moist to wet						
17													
18							18.0 gray fine to coarse sand, wet				18.0		
	SS #4	13	4 2 2 3				18.5 gray coarse sand and gravel (rounded to subang. poorly sorted), wet						water filled borehole and rose to 6.5' BG
20													
											23.0		
24							24.0 gray clay some fine sand, wet						
25	SS #5	6	14 26 31 32										
26							T.O. = 26.0'						



ADDITIONAL REMARKS

Note: • there is no separate geologic log for well OW-1A
• Shallow well OW-1A is screened from 9.5'-4.5' BG.

AWD TECHNOLOGIES

WELL NO. OW-2B

PAGE 1 **OF** 1

PROJECT NAME ECC Phase II SI

PROJECT NO. 2259-??

BY D. Roggery

DATE 1-9-93

CHK BY

DATE

LOCATION Enviro-Chem Site

DRILLING CONTRACTOR Reynolds, Inc.

DRILLING METHOD 6 1/4" Hollow Stem Auger

DRILLING START DATE 1-9-93

SURFACE ELEVATION

GEOLOGIST D. Roggery

DRILLER Danny Allen

RIG TYPE Mobile Drill B-53

DRILLING COMPLETION DATE 1-9-93

STICK-UP ELEVATION

DEPTH FEET	SOIL SAMPLE NO.	REC. (IN.)	BL./6"	ROCK SAMPLE RUN (FT)	REC. (%)	RQD. (%)	VISUAL CLASSIFICATION AND REMARKS	PROFILE	STATIC WATER LEVEL (FT)	BORING/CASING DIA. (IN.)	DEPTH (FEET)	WELL CONSTRUCTION DETAILS	REMARKS
0							- Brown to orange, silt and clay, hard, damp						Log for 0'-15' from DT-TP #1 and #2
							2.0 - Brown silt, little gravel and fine sand, hard, damp						
5							4.5 - gray silt, little fine sand and small gravel (< 1/4"), moist						
10													
							grades to more clay					14.0	
15	SS #1	18"	3 7 9 11				- gray silt and clay, little 16.0 rock frags, moist/wet						
17							- gray fine sand and silt, wet					17.5	
							19.0						
20	SS #2	16"	9 11 9 12				gray to black coarse sand and poorly sorted gravel, wet					19.0	
							TD = 24.0'					24.0	still in sand and gravel at 24'
25													

ADDITIONAL REMARKS

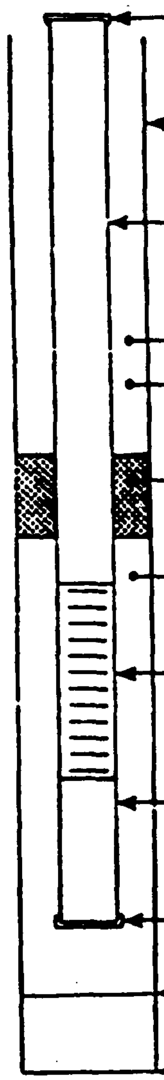
Note: • There is no separate geologic log for well OW-2A
• Shallow well OW-2A is screened from 9.5'-4.5' BGS

APPENDIX C

OBSERVATION PIEZOMETER CONSTRUCTION DETAILS

FIELD WELL COMPLETION FORM

JOB NAME: ECC Phase II SI	
JOB NUMBER: 2259-??	PROJECT MANAGER: Grant Grow
LOGGED BY: D. Ruggeri	EDITED BY:
WELL NAME: GW-1A	DATE: 1-10-93
DRILLING COMPANY: Reynolds Inc	
EQUIPMENT: ☒ 6 1/4 INCH HOLLOW STEM AUGER ☐ ______ INCH ROTARY WASH	DRILLER: Danny Allen HOURS DRILLED:



TOP OF CASING AT ____ FEET ABOVE AT BELOW GROUND LEVEL

10 INCH DIAMETER BOREHOLE 0 to 9.5 feet

2 INCH DIAMETER BLANK CASING 0 to 4 feet

☒ BENTONITE-CEMENT SEAL OR
☐ 8-SACK CEMENT-SAND SEAL 0 to 3 feet

BENTONITE PELLET SEAL 3 to 4 feet

Pool Filter Sand (coarse sand)
(NAME) (NUMBER)
SAND PACK 4 to 9.5 feet

2 INCH DIAMETER SLOTTED : 10 Slot Wire Wrap SCREEN 4.0 to 9.0 feet

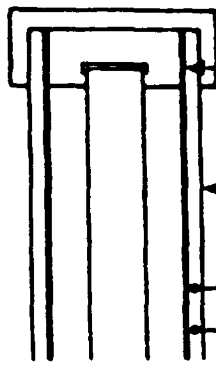
2 INCH DIAMETER BLANK SILT TRAP 9.0 to 9.5 feet

BOTTOM WELL CAP 9.5 feet

HOLE CLEANED OUT TO 9.5 feet

BOTTOM OF BOREHOLE 9.5 feet

NOT TO SCALE



☐ CHRISTY BOX
☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR
☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

NOT TO SCALE

No protective cover

ADDITIONAL INFORMATION:

No soil samples taken

AWD TECHNOLOGIES

FIELD WELL COMPLETION FORM

JOB NAME: ECC Phase II SI

JOB NUMBER: 2259-820 | PROJECT MANAGER: Brad Grow

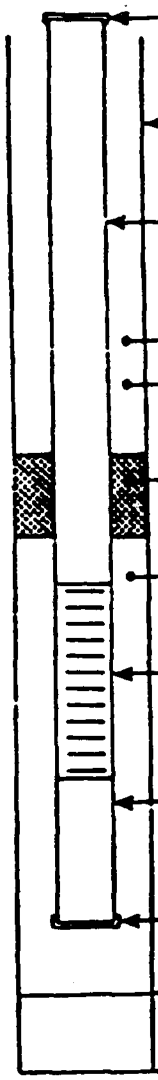
LOGGED BY: D. Ruggery | EDITED BY:

WELL NAME: OW-1B | DATE: 7-10-93

DRILLING COMPANY: Reynolds Inc.

EQUIPMENT: ☒ 6¼ INCH HOLLOW STEM AUGER | DRILLER: Danny Allison

☐ ____ INCH ROTARY WASH | HOURS DRILLED:



TOP OF CASING AT ____ FEET ABOVE AT BELOW GROUND LEVEL

10 INCH DIAMETER BOREHOLE 0 to 24 feet

2 INCH DIAMETER BLANK CASING 0 to 18 feet

☒ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 14 feet

BENTONITE PELLET SEAL 14 to 17.5 feet

Pool Filter Sand (coarse sand)
(NAME) (NUMBER)
SAND PACK 17.5 to 24 feet

2 INCH DIAMETER SLOTTED 10 slot wire wrap inch SCREEN 18 to 23 feet

2 INCH DIAMETER BLANK SILT TRAP 23 to 23.5 feet

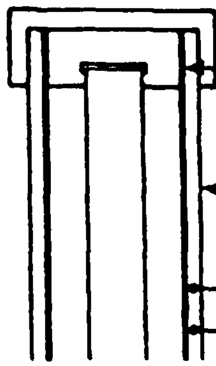
BOTTOM WELL CAP 23.5 feet

HOLE CLEANED OUT TO 24 feet

BOTTOM OF BOREHOLE 24 feet

NOT TO SCALE

[Split Spoon Sample to 26']



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

____ INCH DIAMETER STEEL CONDUCTOR CASING ____ to ____ feet

____ INCH DIAMETER BOREHOLE ____ to ____ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ____ to ____ feet

NOT TO SCALE

No protective cover

ADDITIONAL INFORMATION:

AWD TECHNOLOGIES

FIELD WELL COMPLETION FORM

JOB NAME: ECC Phase II SI

JOB NUMBER: 2259-820 | PROJECT MANAGER: Brad Grow

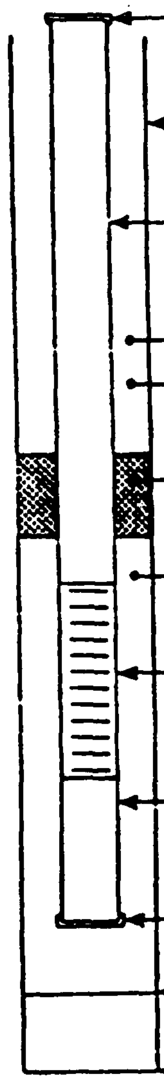
LOGGED BY: O. Ruggery | EDITED BY:

WELL NAME: OW - 2A | DATE: 1-10-93

DRILLING COMPANY: Reynolds, Inc

EQUIPMENT: ☒ 6 1/4 INCH HOLLOW STEM AUGER | DRILLER: Danny Allan

☐ ______ INCH ROTARY WASH | HOURS DRILLED:



TOP OF CASING AT ______ FEET ABOVE AT BELOW GROUND LEVEL

10 INCH DIAMETER BOREHOLE 0 to 9.5 feet

2 INCH DIAMETER BLANK CASING 0 to 4 feet

☒ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 3 feet

BENTONITE PELLET SEAL 3 to 4 feet

Pool Filter Sand (NAME) (NUMBER) SAND PACK 4 to 9.5 feet

2 INCH DIAMETER SLOTTED (10 slot Wire Wrap) (inch) SCREEN 4.0 to 9.0 feet

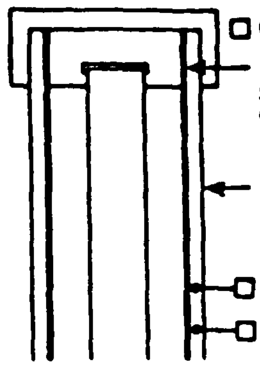
2 INCH DIAMETER BLANK SILT TRAP 9.0 to 9.5 feet

BOTTOM WELL CAP 9.5 feet

HOLE CLEANED OUT TO 9.5 feet

BOTTOM OF BOREHOLE 9.5 feet

NOT TO SCALE



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

______ INCH DIAMETER STEEL CONDUCTOR CASING ______ to ______ feet

______ INCH DIAMETER BOREHOLE ______ to ______ feet

☐ BENTONITE-CEMENT SEAL OR

☐ 8-SACK CEMENT-SAND SEAL ______ to ______ feet

NOT TO SCALE

No protective cover

ADDITIONAL INFORMATION:

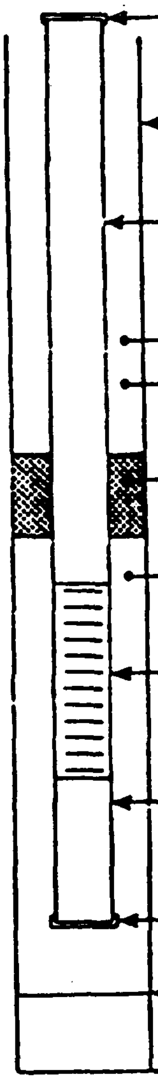
No soil samples taken

AWD TECHNOLOGIES

FIELD WELL COMPLETION FORM

JOB NAME: ECC Phase II III

JOB NUMBER: 2257-5??	PROJECT MANAGER: Brad Grow
LOGGED BY: D. Roggery	EDITED BY:
WELL NAME: OW-2C	DATE: 7-10-73
DRILLING COMPANY: Reynolds Inc	
EQUIPMENT: ☒ 6¼ INCH HOLLOW STEM AUGER ☐ ______ INCH ROTARY WASH	DRILLER: Danny Allen HOURS DRILLED:



TOP OF CASING AT ______ FEET ABOVE AT BELOW GROUND LEVEL

10 INCH DIAMETER BOREHOLE 0 to 24.5 feet

2 INCH DIAMETER BLANK CASING 0 to 19 feet

☒ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL 0 to 14 feet

BENTONITE PELLET SEAL 14 to 17.5 feet

Pool Filter Sand (coarse sand) (NAME) (NUMBER) SAND PACK 17.5 to 24 feet

2 INCH DIAMETER SLOTTED 10 Slot wire wrap inch SCREEN 19 to 24 feet

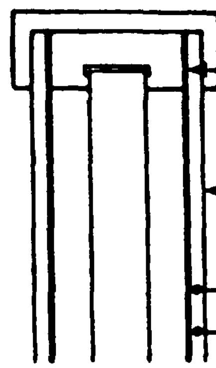
2 INCH DIAMETER BLANK SILT TRAP 24 to 24.5 feet

BOTTOM WELL CAP 24.5 feet

HOLE CLEANED OUT TO 24.5 feet

BOTTOM OF BOREHOLE 24.5 feet

NOT TO SCALE



☐ CHRISTY BOX

☐ LOCKING STEEL COVER

______ INCH DIAMETER STEEL CONDUCTOR CASING ______ to ______ feet

______ INCH DIAMETER BOREHOLE ______ to ______ feet

☐ BENTONITE-CEMENT SEAL OR ☐ 8-SACK CEMENT-SAND SEAL ______ to ______ feet

NOT TO SCALE

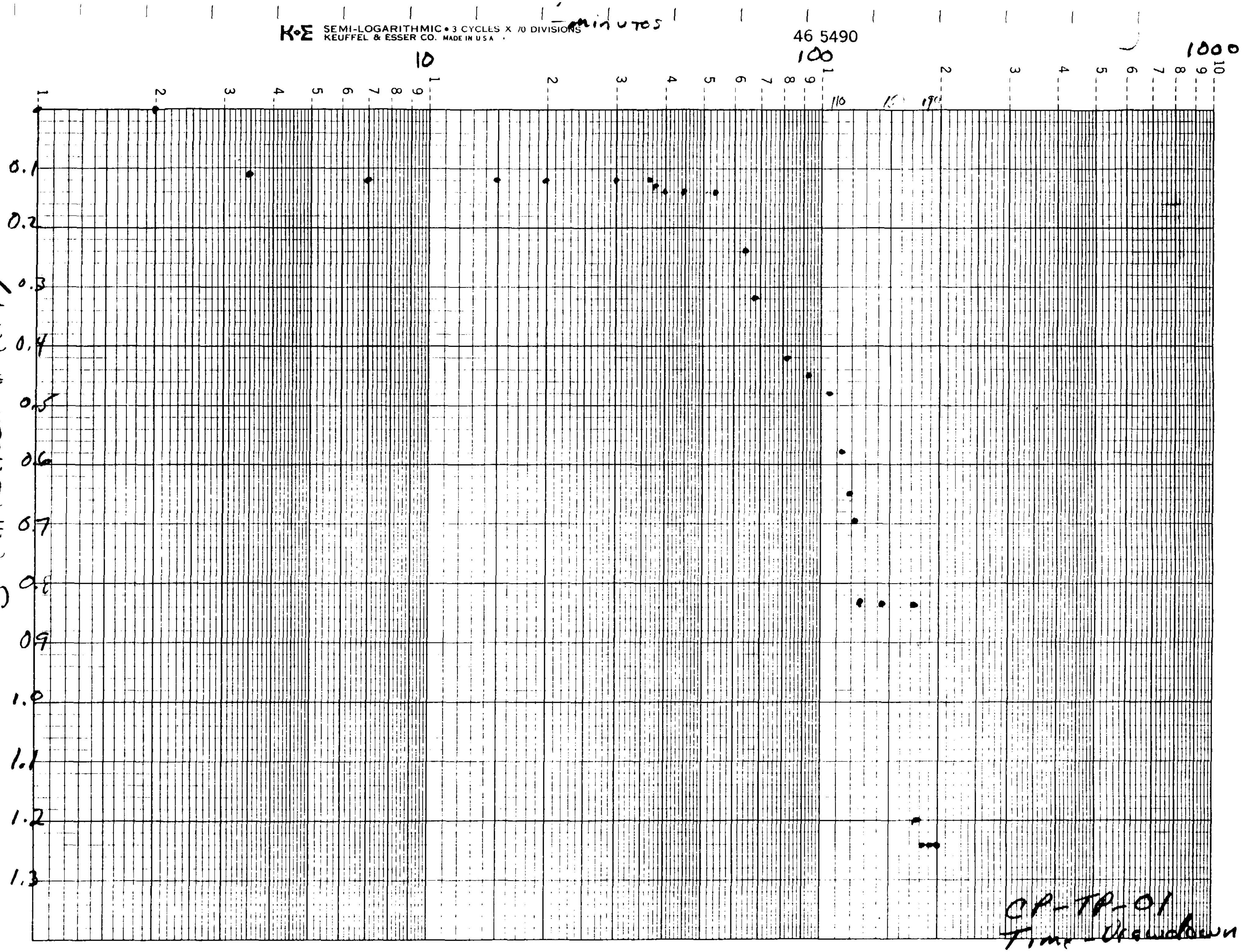
No protective cover

ADDITIONAL INFORMATION: ______

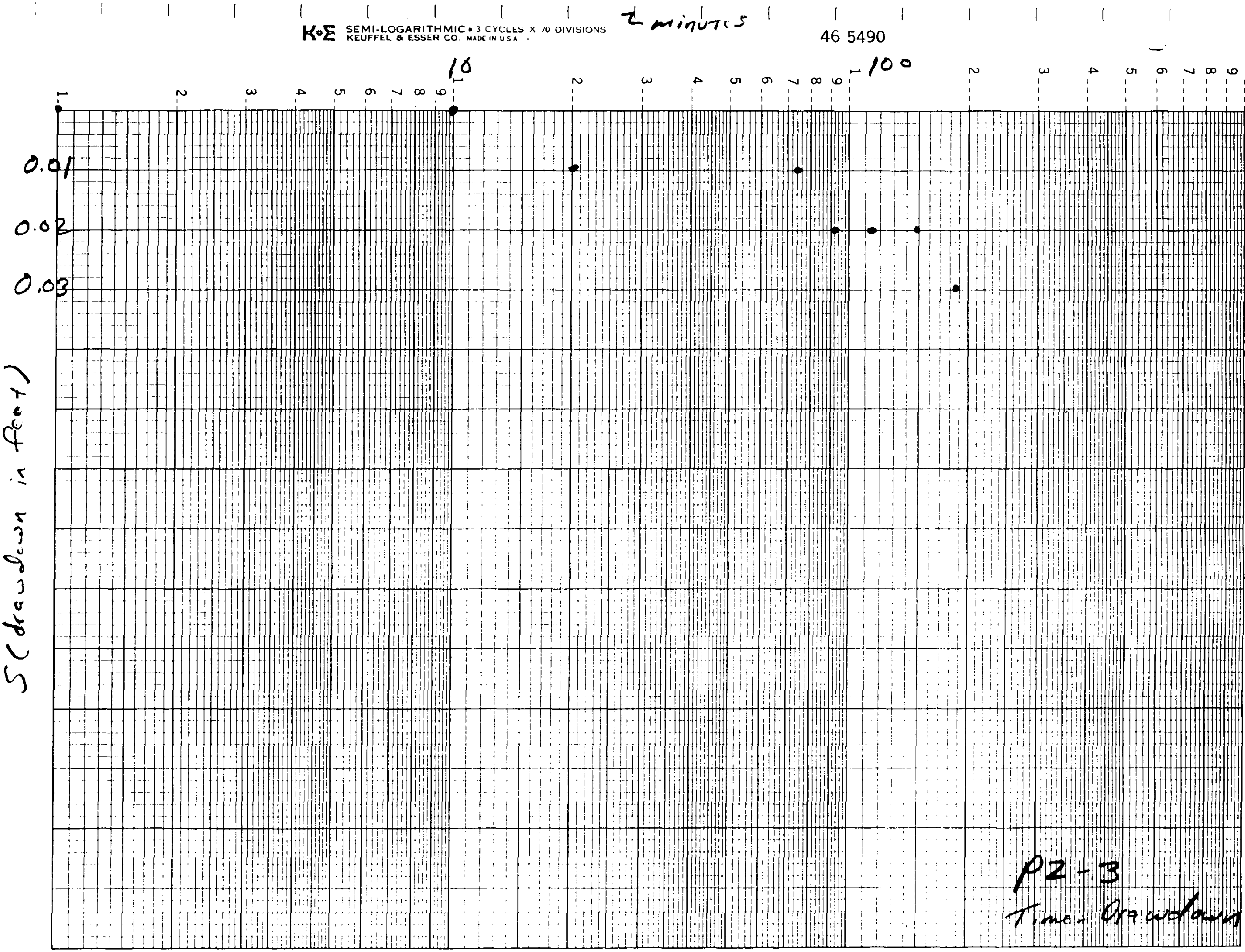
AWD TECHNOLOGIES

APPENDIX D

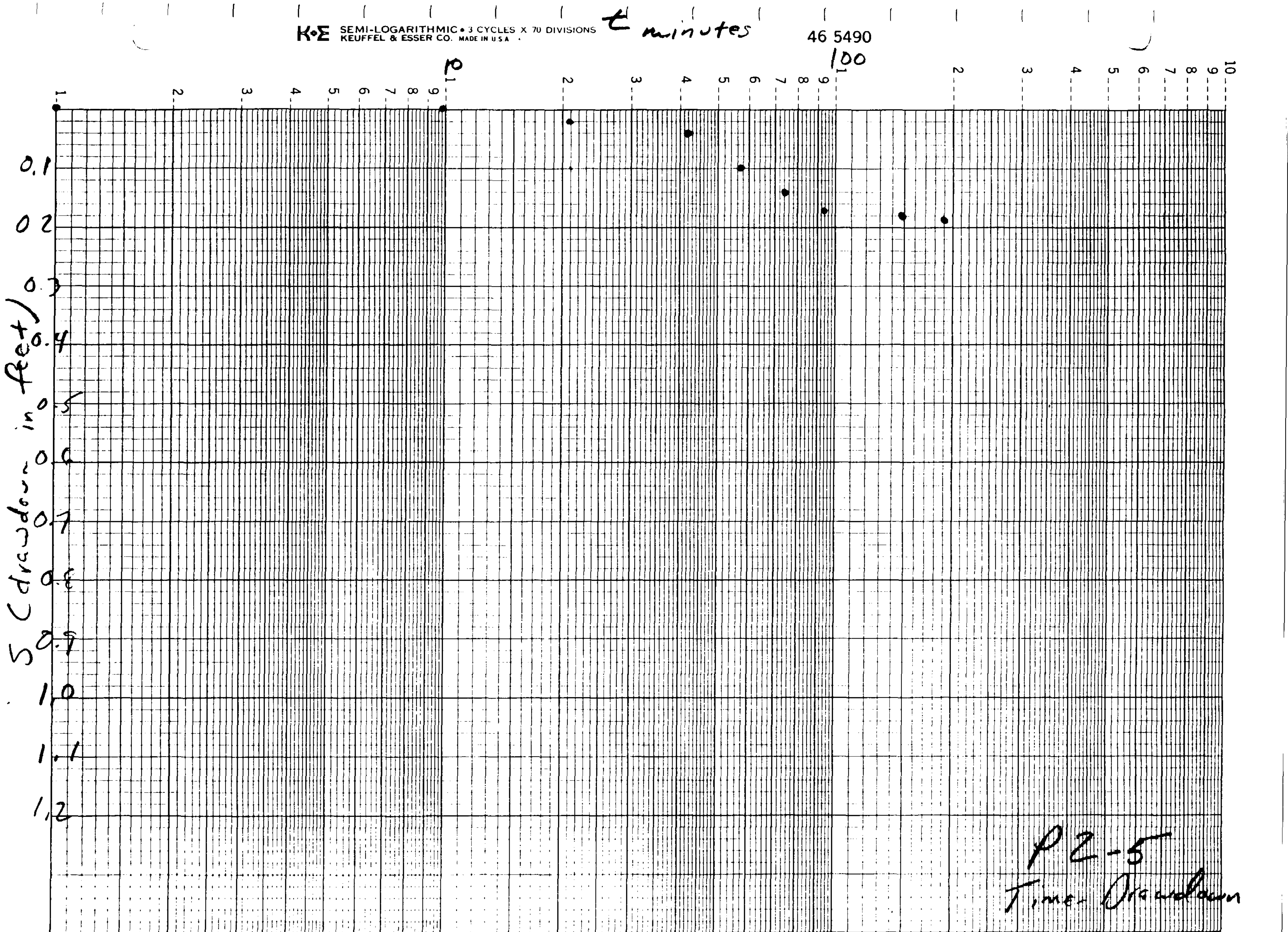
CP-TP-01
PUMPING TEST DATA AND CURVES



K•E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5490
minutes
10
100
1000
S (drawdown in feet)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
CP-TP-01
Time-Drawdown



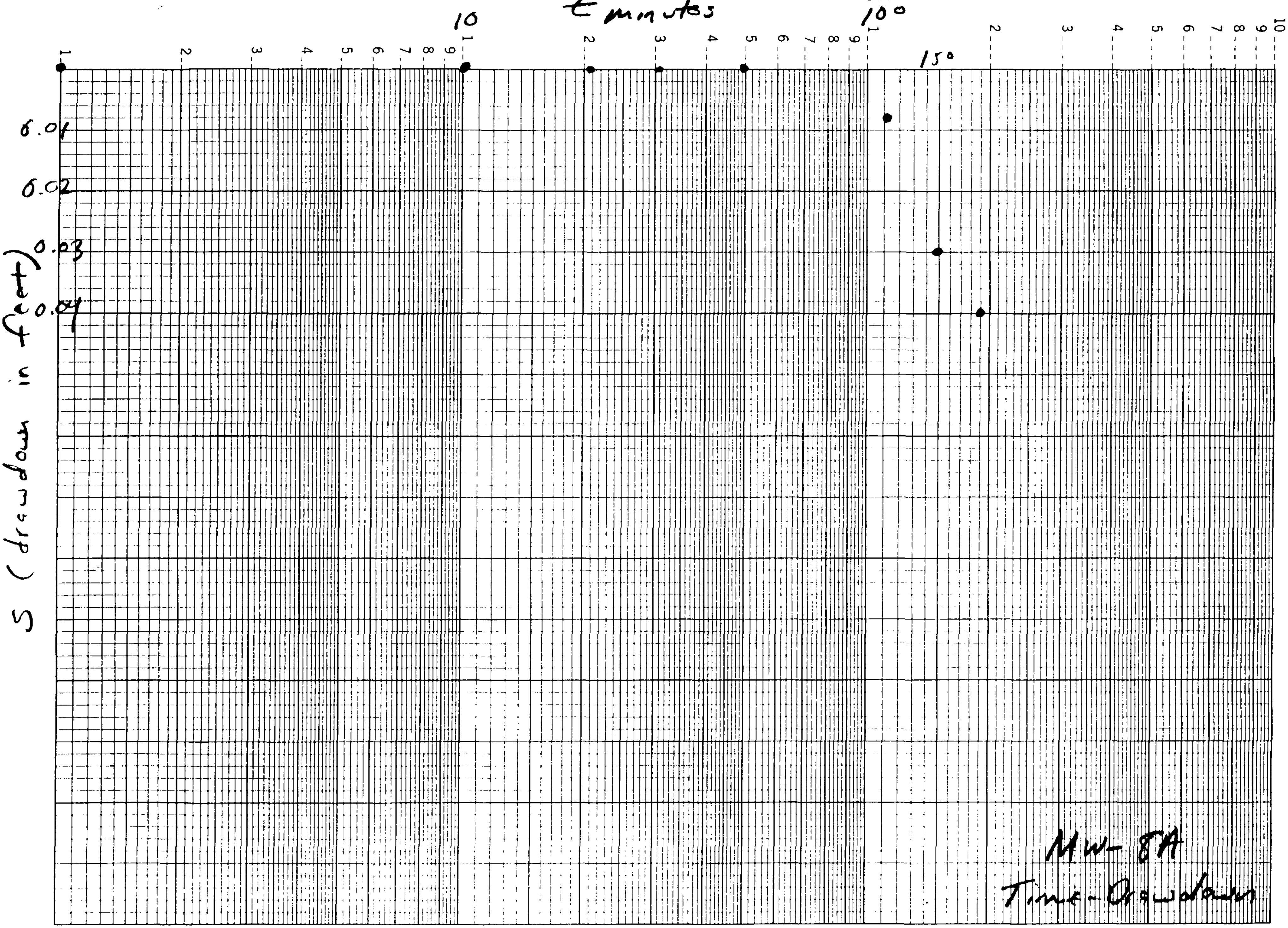
K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
t minutes
46 5490
10
100
0.01
0.02
0.03
S (drawdown in feet)
P2-3
Time-Drawdown



K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5490
t minutes
1
10
100
s (drawdown in feet)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
PZ-5
Time-Drawdown

K•E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 5490



AWD TECHNOLOGIES Discharge Log

~~HYDRAULIC CONDUCTIVITY TESTING DATA SHEET~~

PROJECT NAME: ECC Phase II SI		WELL/BORING NO.: Concrete Pad Test Pit	
PROJECT NO.: 2259-820	GEOLOGIST: D. Ruggery		
WELL DIAMETER: Pit Dim' 10'(l) x 5'(w) x 7'(d)	SCREEN LENGTH/DEPTH: NA	TEST NO.: 1	
STATIC WATER LEVEL: (DEPTH / ELEVATION) 0.88 ft below pad surface		DATE: 1-10-93	
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping		CHECKED:	
METHOD OF INDUCING WATER LEVEL CHANGE: 2-inch trash pump with control valve			PAGE 1 OF 2

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	Total [redacted] Meter	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	Discharge (Q) [redacted] in GPM
14:10	0.00		12248			—
14:20	→ Start Test ←					
	1.0					1.3
	3.3		12252			1.3
	8.0		12258			1.4
	14.5		12267			1.3
	25.0		12281			1.3
	34.0		12292			1.3
						raised Q to 4.5 gpm @ 37 minutes
	38.0		12301			4.5
	40.0		12309.5			4.6
	47.0		12340.5			4.5
	52.5		12365			4.3
	59.0		12394			4.5
	64.0		12418			4.5
	79.0		12484			4.3
	115.0		12654			4.6
	140.0		12738			Started taking sample CP-TP-01

FILE: \FORMATS\HCT

AWD TECHNOLOGIES

Discharge Log

~~HYDRAULIC CONDUCTIVITY~~
~~TESTING DATA SHEET~~

PROJECT NAME: ECC Phase II SI	WELL/BORING NO.: Concrete Pad Test Pit
PROJECT NO.: 2259-920	GEOLOGIST: D. Ruggery
WELL DIAMETER: Pit Dim: 10'(l) x 5'(w) x 7'(d) / SCREEN LENGTH/DEPTH: NA	TEST NO.: 1
STATIC WATER LEVEL: (DEPTH / ELEVATION) 0.83 ft below pad surface	DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping	CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 2-inch trash pump with control valve	PAGE 2 OF 2

TIME	ELAPSED TIME (MIN OR SEC.)	MEASURED DEPTH TO WATER (FEET)	Total [redacted]N Meter	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	Discharge (Q) [redacted] in GPM
	159.0		12862			4.6
	176.0		12942			raised Q to approx 8 gpm
	181.0		12975			8
	184.0		12994.5			7.2
	195.0		13055	(Final)		

Total Pumped
810 gallons over
195 minutes.

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AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI

WELL/BORING NO.: Concrete Pad Test Pit

PROJECT NO.: 2259-820

GEOLOGIST: D. Ruggery

WELL DIAMETER: Pit Dim: 10'(l) x 5'(w) x 7'(d)

SCREEN LENGTH/DEPTH: NA

TEST NO.: 1

STATIC WATER LEVEL: (DEPTH / ELEVATION) 0.88 ft below pad surface

DATE: 1-10-93

TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping

CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: 2-inch trash pump with control valve

PAGE 1 OF 4

	TIME	ELAPSED TIME (MIN OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
Start	14:20	0.00	0.88				Q = 1.3 gpm
		0.5	0.88				
		1.0	0.88				
		1.5	0.88				
		2.0	0.88				
		2.5	0.97				Q = 1.4 gpm
		3.0	0.99				
		4.0	0.99				
		5.0	0.99				
		6.0	0.99				
		7.0	1.00				
		12.0	1.00				
		17.0	1.00				
		22.0	1.00				
		27.0	1.00				
		32.0	1.00				
		37.0	1.00				raised Q to 4.5 gpm @ 37 minutes
		38.0	1.01				

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AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI	WELL/BORING NO.: Concrete Pad Test Pit
PROJECT NO.: 2257-820	GEOLOGIST: D. Ruggery
WELL DIAMETER: Pit Dim 10'(l) x 5'(w) x 7'(d) / SCREEN LENGTH/DEPTH: NA	TEST NO.: 1
STATIC WATER LEVEL: (DEPTH / ELEVATION) 0.88 ft below pad surface	DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping	CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 2-inch trash pump with control valve	PAGE 2 OF 4

TIME	ELAPSED TIME (MIN OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
	38.5	1.01				
	39.5	1.02				
	40 5	1.02				
	41.5	1.02				Q = 4.5 gpm
	42.5	1.02				
	43.5	1.02				
	44.5	1.02				
	45 5	1.02				
	46.5	1.02				
	47 5	1.02				
	52.0	1.02				
	57.0	1.02				
	62.0	1.12				
	68.0	1.20				
	73.0	1.22				
	78.0	1.23				
	83.0	1.30				
	88.0	1.32				

AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI			WELL/BORING NO.: Concrete Pad Test Pit
PROJECT NO.: 2259-820	GEOLOGIST: D. Ruggery		
WELL DIAMETER: Pit Dim 10'(l)x5'(w)x7'(d)	SCREEN LENGTH/ DEPTH: NA		TEST NO.: 1
STATIC WATER LEVEL: (DEPTH / ELEVATION) 8.88 ft below pad surface			DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping			CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 2-inch trash pump with control valve			PAGE 3 OF 4

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
	93.0	1.33				Q = 4.5 gpm
	98.0	1.33				
	103.0	1.33				
	108.0	1.36				Water level at base of gravel
	113.0	1.46				
	118.0	1.53				
	123.0	1.57				
	128.0	1.71				
	133.0	1.71				
	138.0	1.71				
	140.0	} took discharge sample				
	175.0	CP-TP-01				
	176.0	1.71				
	176.5	1.90				raised Q to approx 8 gpm @ 176 minutes
	177.0	2.08				
	178.0	2.10				
	179.0	2.10				
	180.0	2.12				

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AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI	WELL/BORING NO.: Concrete Pad / Test Pit
PROJECT NO.: 2259-020 GEOLOGIST: O. Ruggery	
WELL DIAMETER: Pit Dim: 10'(L) x 5'(w) x 7'(d) SCREEN LENGTH/DEPTH: NA	TEST NO.: 1
STATIC WATER LEVEL: (DEPTH / ELEVATION) 0.88 ft. below pad surface	DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping	CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE:	PAGE 4 OF 4

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
	181.0	2.12				Q = 8gpm
	193.0	2.12				
17:35	193.0	→ End of Test ←				
	1-11-93 10:15	1.20				

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AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI | WELL/BORING NO.: PZ-3

PROJECT NO.: 2259-820 | GEOLOGIST: D. Ruggery

WELL DIAMETER: 2" | SCREEN LENGTH/DEPTH: 4ft / 4.65 ft | TEST NO.: 1

STATIC WATER LEVEL: (DEPTH / ELEVATION) 2.20' TOC | DATE: 1-16-93

TEST TYPE: (RISING/FALLING/CONSTANT HEAD) | METHOD OF INDUCING WATER LEVEL CHANGE: Variable Rate Pumping of CP-TP-#1 | CHECKED: | PAGE 1 OF 1

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
14:10	—	2.20				Note: PZ-3 is 29ft North of CP-TP-#1
14:20	→ Start Test ←					
	10.0	2.20				Q= 1.3 gpm
	20.0	2.21				
	31.0	2.21				
	41.0	2.21				Q raised to 4.5gpm @ 37 minute.
	55.0	2.21				
	75.0	2.21				
	92.0	2.22				
	112.0	2.22				
	150.0	2.22				
	187.0	2.23				Q raised to 8gpm @ 176 minutes
	193.0 → End of Test ←					
	1-11-93 10:20	2.28				

AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI	WELL/BORING NO.: PZ-5
PROJECT NO.: 2259-820	GEOLOGIST: D. Ruggery
WELL DIAMETER: 2"	SCREEN LENGTH/DEPTH: 4 ft / 4.71 ft.
TEST NO.: 1	
STATIC WATER LEVEL: (DEPTH / ELEVATION) 1.68' TOC	DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) / METHOD OF INDUCING WATER LEVEL CHANGE: Variable Rate Pumping of CP-TP-#1	CHECKED:
	PAGE 1 OF 1

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
14:15	—	1.68				Note: PZ-5 is 17 ft south of CP-TP-#1
14:20	→		Start	Test	←	
	11.0	1.68				Q = 1.3 gpm
	21.0	1.70				
	32.0	1.70				
	42.0	1.72				Q raised to 4.5 gpm @ 37 minute
	57.0	1.78				
	75.0	1.82				
	94.0	1.85				
	113.0	1.85(5)				
	152.0	1.86				
	190.0	1.87				Q raised to [illegible] gpm @ 176 minute
	193.0	→	End of	Test	←	
1-11-93 10:20		1.86				

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AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II - I	WELL/BORING NO.: ECC-MW-8A
PROJECT NO.: 2259-820	GEOLOGIST: D. Ruggery
WELL DIAMETER: 2"	SCREEN LENGTH/DEPTH: 5' / 25'
TEST NO.: 1	DATE: 1-10-93
STATIC WATER LEVEL: (DEPTH / ELEVATION) 4.62' TOC	CHECKED:
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) / METHOD OF INDUCING WATER LEVEL CHANGE: [Variable Rate Pumping of CP-TP-#1]	PAGE 1 OF 1

TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
14:10	—	4.62				Note: MW-8A is 57 ft northeast of CP-TP-#1
14:20	→	→	Start	Test	←	←
	10.0	4.62				Q = 1.3 gpm
	20.0	4.62				
	31.0	4.62				
	41.0	4.62				Q raised to 4.5 gpm @ 37 minutes
	55.0	4.62				
	75.0	4.62				
	92.0	4.62				
	112.0	4.63				
	150.0	4.65				
	188.0	4.66				Q raised to 8 gpm @ 176 minutes
	193.0	→	End of		Test	←
1-11-93 10:20		4.62				

AWD TECHNOLOGIES

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

PROJECT NAME: ECC Phase II SI		WELL/BORING NOS: OW-1A, 1B, 2A, 2B
PROJECT NO.: 2259-820	GEOLOGIST: D. Ruggery	
WELL DIAMETER: 2" (all)	SCREEN LENGTH/DEPTH: 5 ft (all)	TEST NO.: 1
STATIC WATER LEVEL: (DEPTH / ELEVATION) (SEE Below)		DATE: 1-10-93
TEST TYPE: (RISING/FALLING/CONSTANT HEAD) Variable Rate Pumping of CP-TP-#1		CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE:		PAGE 1 OF 1

	TIME	ELAPSED TIME (MIN. OR SEC.)	MEASURED DEPTH TO WATER (FEET)	CORRECTION	DEPTH TO WATER (FEET)	DRAWDOWN OR HEAD (FEET)	REMARKS
(1)	OW-	1A					
	14:00		9.32				t = static
	17:00	157.0	9.30				t = just prior to end of test
	1-11-93 10:30		9.26				
(2)	OW-	1B					
	14:00		5.71				
	17:00	157.0	5.74				
	1-11-93 10:30		5.80				
(3)	OW-	2A					
	14:05		dry at	10.8'	TOC		
	1-11-93 10:15		dry at	10.8'	TOC		
(4)	OW-	2B					
	14:05		6.98				
	1-11-93 10:15		7.06				

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APPENDIX E

WATER DISPOSAL ANALYSIS AND MANIFEST

TEL No. Feb 03.93 10:13

DIVISION OF LAND POLLUTION CONTROL

P.O. BOX 19276 SPRINGFIELD, ILLINOIS 62794-9276 (217) 782-6761

FOR SHIPMENT OF HAZARDOUS AND SPECIAL WASTE

State Form LPC 62 8/81 IL532-0610

EPA Form 8700-22 (Rev. 6-89)

Form Approved. OMB No. 2050-0039. Expires 9-30-92

TE: FORM DESIGNED TO PRINT 8 LINES PER INCH.

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: IND094259951
Manifest Document No.: 3448
2. Page 1 of 1
Information in the shaded areas is not required by Federal law, but is required by Illinois Law.

3. Generator's Name and Mailing Address: ENVIRO-CHEM, 865 SOUTH ROUTE 421, ZIONSVILLE, IN 46077
Location If Different:

4. 24 HOUR EMERGENCY AND SPILL ASSISTANCE NUMBERS: (317) 469-0703

A. Illinois Manifest Document Number: IL 4710032 — Fee Paid, If Applicable

B. Illinois Generator's ID: 9780113001

5. Transporter 1 Company Name: MR. FRANK
6. US EPA ID Number: ILD984775049
C. Illinois Transporter's ID: 0079
D. Transporter's Phone: 800 426-7549

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. Illinois Transporter's ID:
F. Transporter's Phone:

9. Designated Facility Name and Site Address: CLEAN HARBORS ENV. SERVICES, 11800 So. STONY ISLAND AVE., CHICAGO, ILL 60617
10. US EPA ID Number: ILD000608471
G. Illinois Facility's ID: 0316900051
H. Facility's Phone: (312) 646-6202

11. US DOT Description (including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. HAZARDOUS WASTE LIQUID, N.O.S. ORM-E NA 9189. (TETRACHLOROETHYLENE, TRICHLOROETHYLENE)	001	TT	03200	G	EPA HW Number: XXD034 Authorization Number: 0002341
b.					EPA HW Number: XX Authorization Number:
c.					EPA HW Number: XX Authorization Number:
d.					EPA HW Number: XX Authorization Number:

J. Additional Descriptions for Materials Listed Above: 11a. D040

K. Handling Codes for Wastes Listed Above in Item # 14: G = Gallons Y = Cubic Yards

15. Special Handling Instructions and Additional Information: W.O. # CN 5508 ERG # 31
24HR EMERGENCY PHONE NUMBER 1-800-645-8265

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed / Typed Name: MARK A. MIHALC — BEHALF OF THE ECC TRUSTEES
Signature: [signature]
Date (Month Day Year): 01/17/93

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed / Typed Name: CARL E PROSSER
Signature: [signature]
Date (Month Day Year): 01/11/93

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed / Typed Name:
Signature:
Date (Month Day Year):

19. Discrepancy Indication Space

557151

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.
Printed / Typed Name: WILLIE R. F. PRUITT
Signature: [signature]
Date (Month Day Year): 01/18/93

This Agency is authorized to require, pursuant to Illinois Revised Statutes, 1989, Chapter 111 1/2, Section 1004 and 1021, that this information be submitted to the Agency. Failure to provide this information may result in a civil penalty against the owner or operator not to exceed $25,000 per day of violation. Falsification of this information may result in a fine up to $50,000 per day of violation and imprisonment up to 5 years. This form has been approved by the Forms Management Center.

In case of a spill call the Illinois Office of Emergency Response at 217/782-7860 and the National Response Center at 800/424-8802 or 202/426-2675.

COPY 3: TSD COPY COPY

/ ENVIRO-CHEM

DRUM ANALYSIS (QUICK 6)

SAMPLE TRACKING #

PROFILE # T30138

DATE 12-29-92 QTY 85,000

DESCRIPTION Q6

ANALYSIS TO BE PERFORMED

CHECK	TEST NEEDED	CODES	RESULTS
	APPEARANCE		H2O 2% solids
	H(2)O MIX		(+)
\	PH		7.0
	IGNITIBILITY		(–)
	REACTIVE CN		(–)
	REACTIVE S		(–)
	PCB		
	CL		ND
	TOX		
	BTU		< 5000
	FLASH		>140°F

COMMENTS: Neutr 0.15mls of 1N NaOH for a 1mL aliquot to pH 10

What are the USEPA HAZ. Waste #'s ?

S.G. = 0.989

A24

Should flage

APPENDIX F

GROUNDWATER ANALYTICAL SAMPLE LABORATORY RESULTS

Analysis Report

Lancaster Laboratories
Where quality is a science.

08:37:50 364875 REP
ASR000 D 1 2
06948 0

LLI Sample No. WW 1915692
Date Reported 2/ 1/93
Date Submitted 1/12/93
Discard Date 2/ 9/93

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
TB92356 Trip Blank Water Sample
EEC Phase II SI Project No. 2259 820

Time Collected
P.O. 2259-820
Rel.

TB923 SDG#

ANALYSIS	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Purgeables (SW846/8240)		attached		150827000 *
Acetone	< 100.	ug/l	100.	900101000
2-Butanone	< 100.	ug/l	100.	900201000
4-Methyl-2-Pentanone	< 50.	ug/l	50.	900301000

1 COPY TO AWD Technologies, Inc. ATTN: Mr. Don Ruggery

Questions? Contact Environmental
Client Services at (717) 656-2301
104 06948 0.00 030000

Respectfully Submitted
Lancaster Laboratories, Inc.

Ramona V. Layman, Group Leader
Instrumental Water Chemistry

Lancaster Laboratories Inc
2425 New Holland Pike
Lancaster PA 17601-5994
717-656-2301

Lancaster Laboratories
Where quality is a science.

08:37:52 364875 REP
ASR000 D 1 2
06948 0

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
TB92356 Trip Blank Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915692
Date Reported 2/ 1/93
Date Submitted 1/12/93
Discard Date 2/ 9/93

Time Collected
P.O. 2259-820
Rel.

TB923 SDG# Purgeables (SW846/8240)	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Chloromethane	< 10.	ug/l	10.	125800000N
Bromomethane	< 10.	ug/l	10.	125700000N
Vinyl Chloride	< 10.	ug/l	10.	349200000N
Chloroethane	< 10.	ug/l	10.	349400000N
Acrolein	< 100.	ug/l	100.	349500000N
Acrylonitrile	< 100.	ug/l	100.	349600000N
Methylene Chloride	< 5.	ug/l	5.	349700000N
Trichlorofluoromethane	< 5.	ug/l	5.	126400000N
1,1-Dichloroethene	< 5.	ug/l	5.	350000000N
1,1-Dichloroethane	< 5.	ug/l	5.	350100000N
1,2-Dichloroethene (total)	< 5.	ug/l	5.	350200000N
Chloroform	< 5.	ug/l	5.	350300000N
1,2-Dichloroethane	< 5.	ug/l	5.	350400000N
1,1,1-Trichloroethane	< 5.	ug/l	5.	350500000N
Carbon Tetrachloride	< 5.	ug/l	5.	350600000N
Bromodichloromethane	< 5.	ug/l	5.	350800000N
1,1,2,2-Tetrachloroethane	< 5.	ug/l	5.	352300000N
1,2-Dichloropropane	< 5.	ug/l	5.	350900000N
trans-1,3-Dichloropropene	< 5.	ug/l	5.	351000000N
Trichloroethene	< 5.	ug/l	5.	351100000N
Dibromochloromethane	< 5.	ug/l	5.	351200000N
1,1,2-Trichloroethane	< 5.	ug/l	5.	351300000N
Benzene	< 5.	ug/l	5.	351500000N
cis-1,3-Dichloropropene	< 5.	ug/l	5.	351600000N
2-Chloroethyl Vinyl Ether	< 10.	ug/l	10.	364500000N
Bromoform	< 5.	ug/l	5.	351800000N
Tetrachloroethene	< 5.	ug/l	5.	352200000N
Toluene	< 5.	ug/l	5.	352400000N
Chlorobenzene	< 5.	ug/l	5.	352500000N
Ethylbenzene	< 5.	ug/l	5.	352600000N
Xylene (total)	< 5.	ug/l	5.	352900000N

The GC/MS volatile sample was preserved with 1 + 1 HCl to pH < 2. Low recovery of acid labile compounds, such as 2-chloroethyl vinyl ether, is likely to occur.

1 COPY TO AWD Technologies, Inc. ATTN: Mr. Don Ruggery

Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.

Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

Quality Control Report

Lancaster Laboratories
Where quality is a science.

AWD Technologies, Inc.
TB92356 Trip Blank Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. 1915692
Group No. 364875
Page No. 1

1508 Purgeables (SW846/8240)

LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
1258 Chloromethane									
10.	ug/l	< 10.	ug/l	10.0 (1)	95.0	105.0			
1257 Bromomethane									
10.	ug/l	< 10.	ug/l	8.0 (1)	120.0	130.0			
3492 Vinyl Chloride									
10.	ug/l	< 10.	ug/l	11.1 (1)	85.0	95.0			
3494 Chloroethane									
10.	ug/l	< 10.	ug/l	10.0 (1)	95.0	105.0			
3495 Acrolein									
100.	ug/l	< 100.	ug/l	20.7 (1)	86.7	106.7			
3496 Acrylonitrile									
100.	ug/l	< 100.	ug/l	14.3 (1)	86.7	100.0			
3497 Methylene Chloride									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
1264 Trichlorofluoromethane									
5.	ug/l	< 5.	ug/l	0.0 (1)	90.0	90.0			
3500 1,1-Dichloroethene									
5.	ug/l	< 5.	ug/l	8.3 (1)	115.0	125.0			
3501 1,1-Dichloroethane									
5.	ug/l	< 5.	ug/l	3.9	105.0	110.0			
3502 1,2-Dichloroethene (total)									
5.	ug/l	< 5.	ug/l	4.4	110.0	115.0			
3503 Chloroform									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
3504 1,2-Dichloroethane									
5.	ug/l	< 5.	ug/l	14.6 (1)	95.0	110.0			
3505 1,1,1-Trichloroethane									
5.	ug/l	< 5.	ug/l	9.1 (1)	100.0	110.0			
3506 Carbon Tetrachloride									
5.	ug/l	< 5.	ug/l	9.1 (1)	105.0	115.0			
3508 Bromodichloromethane									
5.	ug/l	< 5.	ug/l	11.8 (1)	80.0	90.0			
3523 1,1,2,2-Tetrachloroethane									
5.	ug/l	< 5.	ug/l	10.0 (1)	95.0	105.0			
3509 1,2-Dichloropropane									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
3510 trans-1,3-Dichloropropene									
5.	ug/l	< 5.	ug/l	16.7 (1)	59.7	70.6			
3511 Trichloroethene									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
3512 Dibromochloromethane									
5.	ug/l	< 5.	ug/l	11.1 (1)	85.0	95.0			
3513 1,1,2-Trichloroethane									
5.	ug/l	< 5.	ug/l	10.5 (1)	90.0	100.0			
3515 Benzene									
5.	ug/l	< 5.	ug/l	9.1 (1)	105.0	115.0			
3516 cis-1,3-Dichloropropene									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			

(1) The result for one or both determinations was less than five times the LOQ

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AWD Technologies, Inc.
TB92356 Trip Blank Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. 1915692
Group No. 364875
Page No. 2

LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
3645 2-Chloroethyl Vinyl Ether									
10.	ug/l	< 10.	ug/l	200.0 (1)	50.0	0.0			
3518 Bromoform									
5.	ug/l	< 5.	ug/l	5.7 (1)	85.0	90.0			
3522 Tetrachloroethene									
5.	ug/l	< 5.	ug/l	4.7 (1)	105.0	110.0			
3524 Toluene									
5.	ug/l	< 5.	ug/l	4.7 (1)	105.0	110.0			
3525 Chlorobenzene									
5.	ug/l	< 5.	ug/l	10.0 (1)	95.0	105.0			
3526 Ethylbenzene									
5.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
3529 Xylene (total)									
5.	ug/l	< 5.	ug/l	6.3	101.7	108.3			

(1) The result for one or both determinations was less than five times the LOQ

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AWD Technologies, Inc.
TB92356 Trip Blank Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. 1915692
Group No. 364875

SURROGATE SUMMARY

	SURROGATE	RECOVERY %	SURROGATE LIMITS LOW	HIGH
1508 Purgeables (SW846/8240)	d4-1,2 DCE	98.0	76.0	114.0
	d8-toluene	102.0	88.0	110.0
	BFB	102.0	86.0	115.0

Analysis Report

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14:11:26 364875 REP
ASR000 D 1 2
06948 0

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
Date Submitted 1/12/93
Discard Date 2/10/93
Collected 1/10/93 by DR
Time Collected 1630
P.O. 2259-820
Rel.

CPTP1 SDG#

ANALYSIS	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
PCBs		attached		017311500 *
pH	7.33		0.01	020000700 *
Cyanide, Total	0.006	mg/l	0.005	023704000 *
Arsenic	0.006	mg/l	0.002	024503000 *
Hexavalent Chromium	< 0.02	mg/l	0.02	027602400 *
This sample was submitted past the 24 hour holding time for hexavalent chromium.				
Specific Conductance	843.	umhos/cm	4.	028001100 *
Antimony (furnace method)	< 0.005	mg/l	0.005	104403500 *
Lead (furnace method)	0.028	mg/l	0.003	105503000 *
Acid Extractables (SW846/8270)		attached		142414000 *
Base Neutrals (SW846/8270)		attached		142540000 *
Base Neut., cont (SW846/8270)		attached		142600000 *
Purgeables (SW846/8240)		attached		150827000 *
Barium	0.2	mg/l	0.1	174601400 *
Beryllium	< 0.01	mg/l	0.01	174701400 *
Cadmium	< 0.01	mg/l	0.01	174901400 *
Manganese	0.41	mg/l	0.01	175801400 *
Nickel	< 0.05	mg/l	0.05	176101400 *
Silver	< 0.02	mg/l	0.02	176601400 *
Tin	< 0.3	mg/l	0.3	176901400 *
Vanadium	< 0.01	mg/l	0.01	177101400 *
Zinc	0.05	mg/l	0.04	177201400 *
Acetone	< 1,000.	ug/l	1,000.	900101000
2-Butanone	< 1,000.	ug/l	1,000.	900201000
4-Methyl-2-Pentanone	< 500.	ug/l	500.	900301000

1 COPY TO AWD Technologies, Inc. ATTN: Mr. Don Ruggery

Questions? Contact Environmental
Client Services at (717) 656-2301
128 06948 30.00 128800

Respectfully Submitted
Lancaster Laboratories, Inc.

Ramona V. Layman, Group Leader
Instrumental Water Chemistry

Analysis Report

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14:11:31 364875 REP
ASR000 D 1 2
06948 0

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Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
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Discard Date 2/10/93
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Time Collected 1630
P.O. 2259-820
Rel.

CPTP1 SDG# PCBs	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
PCB-1016	< 0.2	ug/l	0.2	063900000N
PCB-1221	< 0.3	ug/l	0.3	064000000N
PCB-1232	< 0.4	ug/l	0.4	064100000N
PCB-1242	0.2	ug/l	0.1	064200000N
PCB-1248	< 0.2	ug/l	0.2	064300000N
PCB-1254	< 0.2	ug/l	0.2	064400000N
PCB-1260	0.4	ug/l	0.1	064500000N
Total PCB's	0.6	ug/l	0.1	155100000N

The values reported for the Aroclors represent the lowest quantitation limits obtainable. This is due to dilutions or interfering peaks from the presence of Aroclors 1242 and 1260.

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Respectfully Submitted
Lancaster Laboratories, Inc.

Jenifer E. Hess, B.S.
Group Leader Pesticides/PCBs

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14:11:32 364875 REP
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06948 0

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CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915691
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Date Submitted 1/12/93
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Rel.

CPTP1 SDG# Acid Extractables (SW846/8270)	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
2-chlorophenol	< 10.	ug/l	10.	392400000N
phenol	140.	ug/l	10.	392500000N
2-nitrophenol	< 10.	ug/l	10.	392600000N
2,4-dimethylphenol	77.	ug/l	10.	392700000N
2,4-dichlorophenol	< 10.	ug/l	10.	392800000N
4-chloro-3-methylphenol	< 10.	ug/l	10.	392900000N
2,4,6-trichlorophenol	< 10.	ug/l	10.	393000000N
2,4-dinitrophenol	< 25.	ug/l	25.	393100000N
4-nitrophenol	< 25.	ug/l	25.	393200000N
4,6-dinitro-2-methylphenol	< 25.	ug/l	25.	393300000N
pentachlorophenol	< 50.	ug/l	50.	393400000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.

Jon S. Kauffman, Ph.D.
Group Leader, GC/MS

Lancaster Laboratories, Inc.
2425 New Holland Pike
Lancaster, PA 17601-5994
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14:11:36 364875 RFP
ASR000 D 1 2
06948 0

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
Date Submitted 1/12/93
Discard Date 2/10/93
Collected 1/10/93 by DR
Time Collected 1630
P.O. 2259-820
Rel.

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

CPTP1 SDG# Base Neutrals (SW846/8270)	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
N-nitrosodimethylamine	< 10.	ug/l	10.	393500000N
bis (2-chloroethyl) ether	< 10.	ug/l	10.	393600000N
1,3-dichlorobenzene	< 10.	ug/l	10.	393700000N
1,4-dichlorobenzene	< 10.	ug/l	10.	393800000N
1,2-dichlorobenzene	21.	ug/l	10.	393900000N
bis (2-chloroisopropyl) ether	< 10.	ug/l	10.	394000000N
hexachloroethane	< 10.	ug/l	10.	394100000N
N-nitrosodi-n-propylamine	< 10.	ug/l	10.	394200000N
nitrobenzene	< 10.	ug/l	10.	394300000N
isophorone	55.	ug/l	10.	394400000N
bis (2-chloroethoxy) methane	< 10.	ug/l	10.	394500000N
1,2,4-trichlorobenzene	< 10.	ug/l	10.	394600000N
naphthalene	21.	ug/l	10.	394700000N
hexachlorobutadiene	< 10.	ug/l	10.	394800000N
hexachlorocyclopentadiene	< 10.	ug/l	10.	394900000N
2-chloronaphthalene	< 10.	ug/l	10.	395000000N
acenaphthylene	< 10.	ug/l	10.	395100000N
dimethyl phthalate	14.	ug/l	10.	395200000N
2,6-dinitrotoluene	< 10.	ug/l	10.	395300000N
acenaphthene	< 10.	ug/l	10.	395400000N
2,4-dinitrotoluene	< 10.	ug/l	10.	395500000N
fluorene	< 10.	ug/l	10.	395600000N
4-chlorophenyl phenyl ether	< 10.	ug/l	10.	395700000N
diethyl phthalate	400.	ug/l	10.	395800000N
1,2-diphenylhydrazine	< 10.	ug/l	10.	395900000N
N-nitrosodiphenylamine	< 10.	ug/l	10.	396000000N
4-bromophenyl phenyl ether	< 10.	ug/l	10.	396100000N
hexachlorobenzene	< 10.	ug/l	10.	396200000N
phenanthrene	< 10.	ug/l	10.	396300000N

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Questions? Contact Environmental Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.

Jon S. Kauffman, Ph.D.
Group Leader, GC/MS

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994
717-656-2301

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Analysis Report

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14:11:45 364875 REP
ASR000 D 1 2
06948 0

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
Date Submitted 1/12/93
Discard Date 2/10/93
Collected 1/10/93 by DR
Time Collected 1630
P.O. 2259-820
Rel.

CPTP1 SDG# Base Neut., cont (SW846/8270)	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
anthracene	< 10.	ug/l	10.	396400000N
di-n-butyl phthalate	< 10.	ug/l	10.	396500000N
fluoranthene	< 10.	ug/l	10.	396600000N
pyrene	< 10.	ug/l	10.	396700000N
benzidine	< 100.	ug/l	100.	396800000N
butyl benzyl phthalate	11.	ug/l	10.	396900000N
benzo (a) anthracene	< 10.	ug/l	10.	397000000N
chrysene	< 10.	ug/l	10.	397100000N
3,3'-dichlorobenzidine	< 20.	ug/l	20.	397200000N
bis (2-ethylhexyl) phthalate	27.	ug/l	10.	397300000N
di-n-octyl phthalate	< 10.	ug/l	10.	397400000N
benzo (b) fluoranthene	< 10.	ug/l	10.	397500000N
benzo (K) fluoranthene	< 10.	ug/l	10.	397600000N
benzo (a) pyrene	< 10.	ug/l	10.	397700000N
indeno (1,2,3-cd) pyrene	< 10.	ug/l	10.	397800000N
dibenz (a,h) anthracene	< 10.	ug/l	10.	397900000N
benzo (ghi) perylene	< 10.	ug/l	10.	398000000N

1 COPY TO AWD Technologies, Inc. ATTN: Mr. Don Ruggery

Questions? Contact Environmental
Client Services at (717) 656-2301

Respectfully Submitted
Lancaster Laboratories, Inc.

Jon S. Kauffman, Ph.D.
Group Leader, GC/MS

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14:11:51 364875 REP
ASR000 D 1 2
06948 0

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
Date Submitted 1/12/93
Discard Date 2/10/93
Collected 1/10/93 by DR
Time Collected 1630
P.O. 2259-820
Rel.

CPTP1 SDG# Purgeables (SW846/8240)	RESULT AS RECEIVED		LIMIT OF QUANTITATION	LAB CODE
Chloromethane	< 100.	ug/l	100.	125800000N
Bromomethane	< 100.	ug/l	100.	125700000N
Vinyl Chloride	340.	ug/l	100.	349200000N
Chloroethane	290.	ug/l	100.	349400000N
Acrolein	< 1,000.	ug/l	1,000.	349500000N
Acrylonitrile	< 1,000.	ug/l	1,000.	349600000N
Methylene Chloride	1,200.	ug/l	50.	349700000N
Trichlorofluoromethane	100.	ug/l	50.	126400000N
1,1-Dichloroethene	310.	ug/l	50.	350000000N
1,1-Dichloroethane	5,700.	ug/l	50.	350100000N
1,2-Dichloroethene (total)	34,000.	ug/l	50.	350200000N
Chloroform	430.	ug/l	50.	350300000N
1,2-Dichloroethane	67.	ug/l	50.	350400000N
1,1,1-Trichloroethane	14,000.	ug/l	50.	350500000N
Carbon Tetrachloride	< 50.	ug/l	50.	350600000N
Bromodichloromethane	< 50.	ug/l	50.	350800000N
1,1,2,2-Tetrachloroethane	< 50.	ug/l	50.	352300000N
1,2-Dichloropropane	< 50.	ug/l	50.	350900000N
trans-1,3-Dichloropropene	< 50.	ug/l	50.	351000000N
Trichloroethene	1,300.	ug/l	50.	351100000N
Dibromochloromethane	< 50.	ug/l	50.	351200000N
1,1,2-Trichloroethane	120.	ug/l	50.	351300000N
Benzene	< 50.	ug/l	50.	351500000N
cis-1,3-Dichloropropene	< 50.	ug/l	50.	351600000N
2-Chloroethyl Vinyl Ether	< 100.	ug/l	100.	364500000N
Bromoform	< 50.	ug/l	50.	351800000N
Tetrachloroethene	71.	ug/l	50.	352200000N
Toluene	2,200.	ug/l	50.	352400000N
Chlorobenzene	< 50.	ug/l	50.	352500000N
Ethylbenzene	470.	ug/l	50.	352600000N
Xylene (total)	3,400.	ug/l	50.	352900000N

The GC/MS volatile sample was preserved with 1 + 1 HCl to pH < 2. Low recovery of acid labile compounds, such as 2-chloroethyl vinyl ether, is likely to occur.

The quantitation limits for the GC/MS volatile compounds were raised because sample dilution was necessary to bring target compounds into the

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Respectfully Submitted
Lancaster Laboratories, Inc.

Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

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14: :51 364875 REP
ASR.CO D 1 2
06948 0

LLI Sample No. WW 1915691
Date Reported 2/ 2/93
Date Submitted 1/12/93
Discard Date 2/10/93
Collected 1/10/93 by DR
Time Collected 1630
P.O. 2259-820
Rel.

AWD Technologies, Inc.
Building III
Penn Center West, Suite 300
Pittsburgh, PA 15276
CP-TP-01 Grab Water Sample
EEC Phase II SI Project No. 2259 820

CPTP1 SDG# Purgeables (SW846/8240)	RESULT AS RECEIVED	LIMIT OF QUANTITATION	LAB CODE

calibration range of the system.

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Respectfully Submitted
Lancaster Laboratories, Inc.

Michele McClarin, B.A.
Group Leader, GC/MS Volatiles

Lancaster Laboratories, Inc
2425 New Holland Pike
Lancaster, PA 17601-5994
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... for explanation of symbols and abbreviations

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[illegible] Technologies, Inc.
[illegible] Grab Water Sample
[illegible] Phase II SI Project No. 2259 820

LLI Sample No. 1915691
Group No. 364375
Page No. [illegible]

[illegible] Purgeables (SW846/8240)

Code	Analysis	LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
[illegible]	Chloromethane	[illegible]	ug/l	< 10.	ug/l	10.0 (1)	95.0	105.0			
[illegible]	Bromomethane	[illegible]	ug/l	< 10.	ug/l	8.0 (1)	120.0	130.0			
[illegible]	Vinyl Chloride	[illegible]	ug/l	< 10.	ug/l	11.1 (1)	85.0	95.0			
3494	Chloroethane	[illegible]	ug/l	< 10.	ug/l	10.0 (1)	95.0	105.0			
3495	Acrolein	1000.	ug/l	< 100.	ug/l	20.7 (1)	86.7	106.7			
3496	Acrylonitrile	1000.	ug/l	< 100.	ug/l	14.3 (1)	86.7	100.0			
3497	Methylene Chloride	50.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
[illegible]64	Trichlorofluoromethane	[illegible]	ug/l	< 5.	ug/l	0.0 (1)	90.0	90.0			
[illegible]	1,1-Dichloroethene	[illegible]	ug/l	< 5.	ug/l	8.3 (1)	115.0	125.0			
[illegible]	1,1-Dichloroethane	[illegible]	ug/l	< 5.	ug/l	3.9	105.0	110.0			
[illegible]	1,2-Dichloroethene (total)	[illegible]	ug/l	< 5.	ug/l	4.4	110.0	115.0			
[illegible]	Chloroform	[illegible]	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
3504	1,2-Dichloroethane	[illegible]	ug/l	< 5.	ug/l	14.6 (1)	95.0	110.0			
3505	1,1,1-Trichloroethane	50.	ug/l	< 5.	ug/l	9.1 (1)	100.0	110.0			
3506	Carbon Tetrachloride	[illegible]	ug/l	< 5.	ug/l	9.1 (1)	105.0	115.0			
[illegible]	Bromodichloromethane	[illegible]	ug/l	< 5.	ug/l	11.8 (1)	80.0	90.0			
[illegible]	1,1,2,2-Tetrachloroethane	[illegible]	ug/l	< 5.	ug/l	10.0 (1)	95.0	105.0			
[illegible]	1,2-Dichloropropane	[illegible]	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
[illegible]	trans-1,3-Dichloropropene	[illegible]	ug/l	< 5.	ug/l	16.7 (1)	59.7	70.6			
[illegible]	Trichloroethene	50.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
[illegible]2	Dibromochloromethane	[illegible]	ug/l	< 5.	ug/l	11.1 (1)	85.0	95.0			
[illegible]3	1,1,2-Trichloroethane	[illegible]	ug/l	< 5.	ug/l	10.5 (1)	90.0	100.0			
[illegible]5	Benzene	50.	ug/l	< 5.	ug/l	9.1 (1)	105.0	115.0			
[illegible]6	cis-1,3-Dichloropropene	50.	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			

(1) The result for one or both determinations was less than five times the LOQ

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[illegible] Technologies, Inc. — LLI Sample No. 19[illegible]569[illegible]
[illegible] Grab Water Sample — Group No. 364075
[illegible] Phase II SI Project No. 2259 820 — Page No. 2

Analysis	LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
7645 2-Chloroethyl Vinyl Ether	[illegible]	ug/l	< 10.	ug/l	200.0 (1)	50.0	0.0			
[illegible]8 Bromoform	[illegible]	ug/l	< 5.	ug/l	5.7 (1)	85.0	90.0			
[illegible]22 Tetrachloroethene	[illegible]	ug/l	< 5.	ug/l	4.7 (1)	105.0	110.0			
[illegible]24 Toluene	[illegible]	ug/l	< 5.	ug/l	4.7 (1)	105.0	110.0			
[illegible]25 Chlorobenzene	[illegible]	ug/l	< 5.	ug/l	10.0 (1)	95.0	105.0			
[illegible]26 Ethylbenzene	[illegible]	ug/l	< 5.	ug/l	9.5 (1)	100.0	110.0			
[illegible]29 Xylene (total)	[illegible]	ug/l	< 5.	ug/l	6.3	101.7	108.3			
[illegible] Barium	[illegible]	mg/l	< 0.1	mg/l	.8 (1)	101.7		2.0376	1.5998	2.4002
[illegible]47 Beryllium	.01	mg/l	< 0.01	mg/l	0.0 (1)	105.8		.0526	.0400	.0600
[illegible] Cadmium	[illegible]	mg/l	< 0.01	mg/l	3.3 (1)	95.2		.0488	.0400	.0600
[illegible] Manganese	[illegible]	mg/l	< 0.01	mg/l	1.8	99.3		.5077	.4000	.6001
[illegible] Nickel	.05	mg/l	< 0.05	mg/l	28.6 (1)	98.8		.5119	.4000	.6001
[illegible] Silver	.02	mg/l	< 0.02	mg/l	0.0 (1)	98.6		.0479	.0400	.0600
[illegible] Tin	[illegible]	mg/l	< 0.3	mg/l	0.0 (1)	105.1		4.2687	3.1996	4.8004
[illegible] Vanadium	.01	mg/l	< 0.01	mg/l	21.2 (1)	101.9		.4893	.4000	.6001
[illegible] Zinc	[illegible]	mg/l	< 0.04	mg/l	13.0 (1)	100.0		.5209	.4000	.6001
[illegible] Arsenic	.002	mg/l	< 0.002	mg/l	1.8	112.3	109.3	.0274	.0199	.0301
[illegible] Antimony (furnace method)	[illegible]	mg/l	< 0.005	mg/l	0.0 (1)	116.2		.0989	.0800	.1200
[illegible] Lead (furnace method)	.003	mg/l	< 0.003	mg/l	8.1 (1)	85.5		.0203	.0160	.0240
[illegible] PCBs										
[illegible]639 PCB-1016	[illegible]	ug/l	< 0.065	ug/l						
[illegible]640 PCB-1221	[illegible]	ug/l	< 0.065	ug/l						
[illegible]641 PCB-1232	[illegible]	ug/l	< 0.065	ug/l						
0642 PCB-1242	[illegible]	ug/l	< 0.065	ug/l				96.0	74.9	120.0
[illegible]643 PCB-1248	[illegible]	ug/l	< 0.065	ug/l						

(1) The result for one or both determinations was less than five times the LOQ

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[illegible] Technologies, Inc.	LLI Sample No. [illegible]
[illegible] Grab Water Sample	Group No. 364375
[illegible] Phase II SI Project No. 2259 820	Page No. 3

	LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
[illegible]	PCB-1254									
	[illegible]	ug/l	< 0.065	ug/l						
[illegible]	PCB-1260									
	[illegible]	ug/l	< 0.065	ug/l				97.0	76.9	120.0
[illegible]	Total PCB's									
	[illegible]	ug/l	< 0.065	ug/l						
[illegible]	Acid Extractables (SW846/8270)									
[illegible]	2-chlorophenol									
	[illegible]	ug/l	< 10.	ug/l	.7	97.1	96.4			
[illegible]	phenol									
	[illegible]	ug/l	< 10.	ug/l	2.1 (1)	50.1	49.0			
[illegible]	2-nitrophenol									
	[illegible]	ug/l	< 10.	ug/l	1.2	118.5	120.0			
[illegible]	2,4-dimethylphenol									
	[illegible]	ug/l	< 10.	ug/l	.2	90.4	90.2			
[illegible]	2,4-dichlorophenol									
	[illegible]	ug/l	< 10.	ug/l	2.9	100.2	97.3			
[illegible]	4-chloro-3-methylphenol									
	[illegible]	ug/l	< 10.	ug/l	5.4	102.3	96.9			
3930	2,4,6-trichlorophenol									
	[illegible]	ug/l	< 10.	ug/l	1.3	108.9	110.3			
[illegible]	2,4-dinitrophenol									
	[illegible]	ug/l	< 25.	ug/l	3.3 (1)	130.7	126.4			
[illegible]	4-nitrophenol									
	[illegible]	ug/l	< 25.	ug/l	2.2 (1)	48.5	47.4			
[illegible]	4,6-dinitro-2-methylphenol									
	[illegible]	ug/l	< 25.	ug/l	4.3 (1)	128.5	123.1			
[illegible]	pentachlorophenol									
	[illegible]	ug/l	< 50.	ug/l	2.6 (1)	120.7	117.6			
[illegible]	Base Neutrals (SW846/8270)									
3935	N-nitrosodimethylamine									
	[illegible]	ug/l	< 10.	ug/l	5.1	68.4	72.0			
[illegible]	bis (2-chloroethyl) ether									
	[illegible]	ug/l	< 10.	ug/l	2.1	88.5	90.5			
[illegible]	1,3-dichlorobenzene									
	[illegible]	ug/l	< 10.	ug/l	.6	86.0	85.5			
3938	1,4-dichlorobenzene									
	[illegible]	ug/l	< 10.	ug/l	1.0	88.3	87.4			
3939	1,2-dichlorobenzene									
	[illegible]	ug/l	< 10.	ug/l	1.2	86.8	85.8			
[illegible]	bis (2-chloroisopropyl) ether									
	[illegible]	ug/l	< 10.	ug/l	.8	103.9	103.0			
[illegible]	hexachloroethane									
	[illegible]	ug/l	< 10.	ug/l	1.9	76.0	74.6			
[illegible]	N-nitrosodi-n-propylamine									
	[illegible]	ug/l	< 10.	ug/l	4.4	110.0	105.3			

(1) The result for one or both determinations was less than five times the LOQ

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LLI Sample No. 1915691
Group No. 364375
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	LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
3943 nitrobenzene	10.	ug/l	< 10.	ug/l	.6	92.7	92.2			
3944 isophorone	10.	ug/l	< 10.	ug/l	3.1	98.7	95.7			
3945 bis (2-chloroethoxy) methane	10.	ug/l	< 10.	ug/l	1.5	77.2	78.3			
3946 1,2,4-trichlorobenzene	10.	ug/l	< 10.	ug/l	3.1	90.4	93.3			
3947 naphthalene	10.	ug/l	< 10.	ug/l	.3	88.3	88.6			
3948 hexachlorobutadiene	10.	ug/l	< 10.	ug/l	5.3	80.7	85.1			
3949 hexachlorocyclopentadiene	10.	ug/l	< 10.	ug/l	11.1	61.7	69.0			
3950 2-chloronaphthalene	10.	ug/l	< 10.	ug/l	4.7	90.6	94.9			
3951 acenaphthylene	10.	ug/l	< 10.	ug/l	3.6	84.9	88.0			
3952 dimethyl phthalate	10.	ug/l	< 10.	ug/l	.3	81.5	81.2			
3953 2,6-dinitrotoluene	10.	ug/l	< 10.	ug/l	1.9	100.1	98.2			
3954 acenaphthene	10.	ug/l	< 10.	ug/l	3.5	90.5	93.8			
3955 2,4-dinitrotoluene	10.	ug/l	< 10.	ug/l	4.1	109.2	104.8			
3956 fluorene	10.	ug/l	< 10.	ug/l	3.9	87.6	91.0			
3957 4-chlorophenyl phenyl ether	10.	ug/l	< 10.	ug/l	4.8	78.9	82.8			
3958 diethyl phthalate	10.	ug/l	< 10.	ug/l	.7	89.2	89.8			
3959 1,2-diphenylhydrazine	10.	ug/l	< 10.	ug/l	3.6	91.9	95.3			
3960 N-nitrosodiphenylamine	10.	ug/l	< 10.	ug/l	.7	104.5	105.3			
3961 4-bromophenyl phenyl ether	10.	ug/l	< 10.	ug/l	1.1	107.1	108.3			
3962 hexachlorobenzene	10.	ug/l	< 10.	ug/l	.4	105.4	105.8			
3963 phenanthrene	10.	ug/l	< 10.	ug/l	2.1	94.2	96.2			
126 Base Neut., cont (SW846/8270)										
3964 anthracene	10.	ug/l	< 10.	ug/l	2.1	86.9	88.7			
3965 di-n-butyl phthalate	10.	ug/l	< 10.	ug/l	3.9	97.4	101.3			
3966 fluoranthene	10.	ug/l	< 10.	ug/l	2.1	95.0	97.0			

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LLI Sample No. 1915691
Group No. 364375
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LOQ	UNITS	BLANK		MS or D RPD	MS % REC	MSD % REC	LCS	LCS LIMITS LOW	LCS LIMITS HIGH
3967 pyrene									
[illegible]	ug/l	< 10.	ug/l	4.3	102.4	106.9			
[illegible] benzidine									
[illegible]	ug/l	< 100.	ug/l	5.0 (*)	78.3	82.4			
[illegible] butyl benzyl phthalate									
[illegible]	ug/l	< 10.	ug/l	4.4	94.4	98.6			
[illegible] benzo (a) anthracene									
[illegible]	ug/l	< 10.	ug/l	1.6	100.9	102.5			
[illegible] chrysene									
[illegible]	ug/l	< 10.	ug/l	1.1	102.3	103.4			
[illegible] 3,3'-dichlorobenzidine									
[illegible]	ug/l	< 20.	ug/l	12.6 (*)	76.8	87.1			
3973 bis (2-ethylhexyl) phthalate									
[illegible]	ug/l	< 10.	ug/l	5.4	100.1	105.7			
3974 di-n-octyl phthalate									
[illegible]	ug/l	< 10.	ug/l	.8	129.4	130.5			
3975 benzo (b) fluoranthene									
[illegible]	ug/l	< 10.	ug/l	2.2	96.3	94.2			
3976 benzo (K) fluoranthene									
[illegible]	ug/l	< 10.	ug/l	1.1	121.9	123.2			
3977 benzo (a) pyrene									
[illegible]	ug/l	< 10.	ug/l	1.7	112.2	114.1			
3978 indeno (1,2,3-cd) pyrene									
[illegible]	ug/l	< 10.	ug/l	12.9	115.9	131.9			
[illegible] dibenz (a,h) anthracene									
[illegible]	ug/l	< 10.	ug/l	14.1	130.5	150.3			
[illegible] benzo (ghi) perylene									
[illegible]	ug/l	< 10.	ug/l	16.2	118.5	139.3			
[illegible] Cyanide, Total									
.005	mg/l	< 0.005	mg/l	0.0 (*)	87.2		.1920	.1600	.2400
[illegible] pH									
.01				.1			10.0200	9.8198	10.2002
[illegible] Hexavalent Chromium									
.02	mg/l	< 0.02	mg/l	200.0 (*)	91.2		.1946	.1600	.2400
[illegible] Specific Conductance									
4.	umhos/cm	< 4.	umhos/cm	9.5 (*)			142.8766	117.6000	176.4000

(*) The result for one or both determinations was less than five times the LOQ

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[illegible] for explanation of symbols and abbreviations

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LLI Sample No. 1915691
Group No. 364375
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SURROGATE SUMMARY

	SURROGATE	RECOVERY %	SURROGATE LIMITS LOW	SURROGATE LIMITS HIGH
0173 PCBs	TCMX	54.9	60.0	120.0
1424 Acid Extractables (SW846/8270)	d5-phenol	33.2	10.0	94.0
	o-Fphenol	21.0	21.0	100.0
	2,4,6-TBP	94.1	10.0	123.0
1425 Base Neutrals (SW846/8270)	d5-nitrobz	89.6	35.0	114.0
	2-Fbiphen	78.7	43.0	116.0
	d14-TPH	117.9	33.0	141.0
1508 Purgeables (SW846/8240)	d4-1,2 DCE	100.0	76.0	114.0
	d8-toluene	96.0	88.0	110.0
	BFB	99.0	86.0	115.0

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APPENDIX G

DEWATERING CALCULATIONS

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: Ecc Trust	FILE NO.: 2259-820	BY: DAR	PAGE 1 OF
SUBJECT: Revision I Phase II SI Dewatering Calcs		CHECKED BY:	DATE: 3-24-93

Notes: (1) The calculations for dewatering have been separated into 3 areas as follows:

Area A - Rectangular area consisting of the northern third of the site

Area B - "Panhandle" shaped area between the southern edge of Area A and the concrete pad

Area C - The remainder of the area within the remedial boundary - primarily consisting of the concrete pad

(2) Figure 3 presents the locations of these areas.

(3) Areas A and B are assumed to have the same hydraulic parameters based on the results of the Phase II SI. The separation of these areas is based on the potentially different vertical extent of soil contamination within the areas. The existing RI data and Phase II SI field screening suggested that the contamination in Area A was primarily limited to the upper 5 feet of soil and that contamination was present (cont'd)

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 2 OF
SUBJECT: Revision I Phase II SI		CHECKED BY:	DATE: 3-24-93

Dewatering Calcs

Notes: (cont'd)

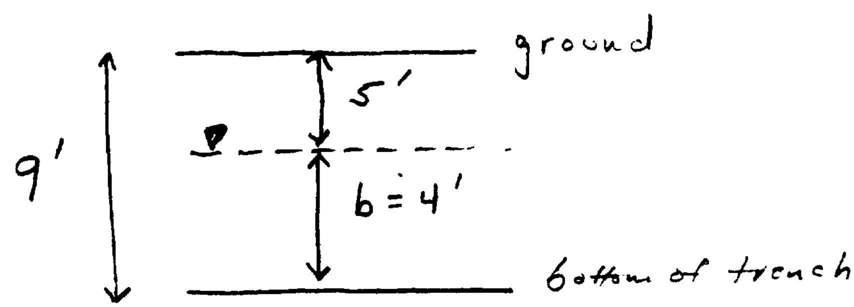
(3) (cont'd) to a depth of at least nine feet in Area B.

(4) The hydraulic parameters used in the Calculations for Area C are different than those for Areas A and B based on the hydrologic conditions observed during the Phase II SI.

I. Area A

IA. Volume of Water In Storage - Area A

- Surface Area = 83,424 ft^2
- $V_{total} = (SA)(b_{saturated})$
- Saturated thickness (b) = 4 feet
- Effective Porosity (n) = 0.10



$V_{total} = (83424)(4) = 333,696\ ft^3$

$V_{liquid} = (V_{total})(n)$
$= (333,696)(0.10)$
$= 33,370\ ft^3$
$= 249,600$ gallons
$\boxed{\cong 250,000 \text{ gallons}}$

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 3 OF
SUBJECT: Region I Phase II SI Dewatering Calcs		CHECKED BY:	DATE: 3-24-93

I Area A (cont'd)

IB. Maintenance Dewatering Rate - Area A

- Problem - Calculate a total flow from a dewatering system that would lower the present water table at the ECC site down to 9 feet BGS with respect to the operation of the SVE

- Assumptions

- That the required site cap will prevent local recharge to the target SVE area (remedial boundary). Therefore, after removal of the groundwater in storage, the dewatering will be necessary to control regional recharge along the remedial boundary

- Based on the Phase II SI data, No vertical leakage from the underlying sand and gravel unit is assumed in Area A

- Assume that no flow will be received from the unnamed ditch

- The saturated thickness (H) is calculated from the top of the saturated zone down to 3 feet above the sand and gravel unit

- The formula used is for a single trench under steady-state flow conditions for a fully penetrated drain

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: CAR	PAGE 4 OF
SUBJECT: Revision I Phase III SI Dewatering Calcs		CHECKED BY:	DATE: 3-24-93

I Area A (cont'd)

IB (cont'd)

- Assumptions (cont'd)

  - Since recharge inside remedial boundary will approach zero, the maintenance dewatering rate may be calculated from assuming the existence of a trench along the perimeter of Area A

- Formula Used:

$$Q = \frac{K\,(H^2 - h^2)\,(x)}{2880\,L_o}$$

= flow per unit length from one side of trench in unconfined conditions

Q = Flow rate in gpm
H = Saturated Thickness
h = distance from bottom of saturated zone to water level in the trench while pumping
L_o = radius of influence
X = Unit length of trench
K = Hydraulic Conductivity

- Values

X = Area A outside Perimeter = 1040 ft
K = 1.0×10^{-5} cm/sec = 0.21 gpd/ft^2

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: Ecc Trust	FILE NO.: 2259-820	BY: OAR	PAGE 5 OF
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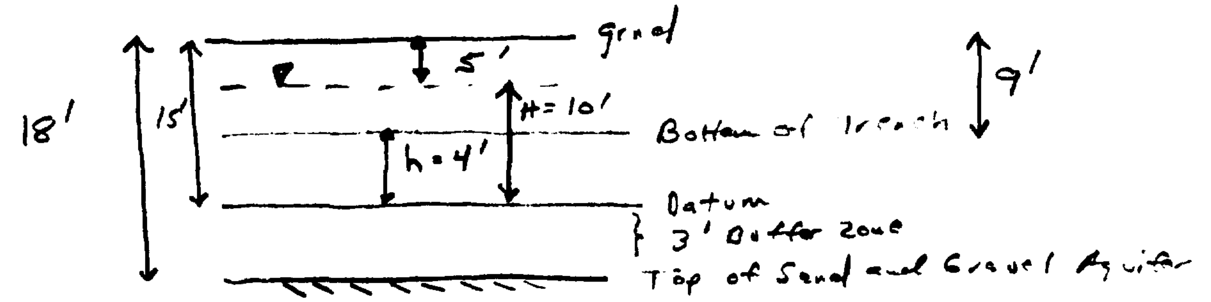
Dewatering Rates

I. (cont'd) IB. (cont'd)

• Values (cont'd)



L_o = radius of influence - estimated from the Sichart Equation which produces a conservative estimate

$$L_o = 3(H-h)\sqrt{K}$$

where H and h are in ft, K in μ/sec

1.0×10^{-5} cm/sec = 0.1 μ/sec

1040' = Outside Perimeter

$$= 3(10-4)\sqrt{0.1}$$

$$= 5.7 \text{ ft.}$$

$$Q_{Area\,A} = \frac{(0.21)[10^2 - 4^2](1040)}{(2880)(5.7)}$$

$$\boxed{Q_{Area\,A} = 1.12 \text{ gpm}}$$

Note: that flow is only calculated from the "face" of the trench that will accept regional flow.

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 3 OF
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Dewatering Calcs

I. (cont'd) IB. (Cont'd)

— The L_o derived from the Sichart Equation is a conservative estimate. A second method can be used to derive L_o that uses the time of dewatering and the effective porosity of the saturated soil. This equation (by Weber) is as follows:

$$R_o = 3\sqrt{\frac{HKt}{n}}$$

For this: t is assumed to be 160 days (see later in Appendix G)

$H = 10' = 3.3\,m$

n is assumed to be 0.10

$K = 1 \times 10^{-7}$ meters/sec

$$R_o = 3\sqrt{\frac{(3.3\,m)(1\times10^{-7}\,m/sec)(13824000)}{0.10}}$$

$$R_o = \sqrt{\frac{4.6}{0.10}}$$

$$R_o = \sqrt{46}$$

$$R_o = 6.8$$

$$\boxed{R_o = 22\ ft}$$

This formula gives a larger value for R_o than the Sichart Equation. However, the low K of the soil suggests the use of the lower value

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 7 OF
SUBJECT: Revision I Phase II SI Dewatering Calcs		CHECKED BY:	DATE: 3-24-93

II. Area B [Same Assumptions As Area A]

II A Volume of Water In Storage – Area B

- Surface Area 18 600 ft^2
- $V_{total} = (SA)(b_{saturated})$
- Saturated Thickness = 4 ft
- Effective Porosity = 0.10

$V_{total} = (18600)(4) = 74,400\ ft^3$

$V_{liquid} = (74,400)(0.10) = 7440\ ft^3$

$= 55,651$ gallons

$\boxed{\cong 55,650 \text{ gallons}}$

II B. Maintenance Dewatering Rate – Area B
[Same Assumptions]

Values:
X = Area B Perimeter = 308 ft
$K = 0.21\ gpd/ft^2$
$H = 10\ ft$
$h = 4\ ft$
$L_o = 5.7\ ft$

$$Q_{Area\ B} = \frac{(0.21)\left[10^2 - 4^2\right](308)}{(2880)(5.7)}$$

$\boxed{Q_{Area\ B} = 0.33\ gpm}$

note that flow is only calculated from the "face" of the trench that will accept regional flow

AWD021 5/90

AWD TECHNOLOGIES

CALCULATION WORKSHEET

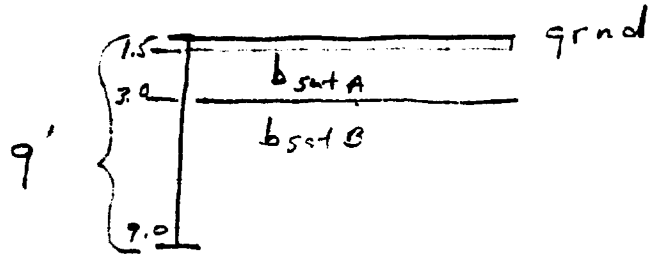
CLIENT: Ecc Trust	FILE NO.: 2259-820	BY: 2259-820	PAGE 8 OF
SUBJECT: [illegible] Phase II SI Dewatering [illegible]		CHECKED BY:	DATE: 3-24-93

III Area C (Concrete Pad Area)

III A. Volume of Water In Storage - Area C

- Surface Area = 31 318 ft^2

- Separate Saturated Thickness into two subsections; Gravel Subbase and Soil



$b_{SAT\,A} = 1.5$ ft

$b_{sat\,B} = 6.0$ ft

- Effective Porosity

$n_A = 0.30$

$n_B = 0.10$

- $V_{total\,A} = (31318)(1.5)$
$= 46,977\ ft^3$

$V_{liquid\,A} = (46,977)(0.30)$
$= 14,093\ ft^3$
$\boxed{= 105,416 \text{ gallons}}$

$V_{total\,B} = (31318)(6.0)$
$= 187,908\ ft^3$

$V_{liquid\,B} = (187,908)(0.10)$
$= 18,791$
$\boxed{= 140,557 \text{ gallons}}$

Total Area C = 105,416 + 140,557 ≐ $\boxed{245,970 \text{ gallons}}$

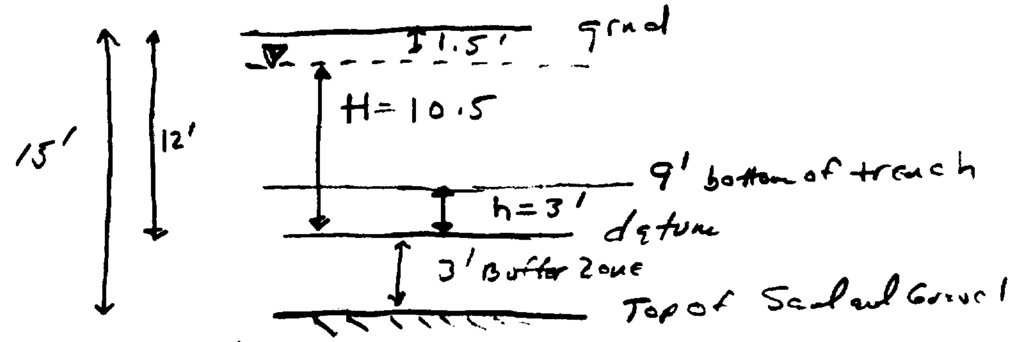
Total A+B+C = 250,000 + 55,650 + 245,970 ≅ 551,620
$\boxed{\cong 552,000 \text{ gallons}}$

III B. Maintenance Dewatering Rate - Area C

- The problem and assumptions for the Concrete pad area (Area C) are the same as those for Areas A and B except:

 – K = 1.0 x 10^{-4} cm/sec – an order of magnitude greater than that of Areas A and B due to occurrence of multiple saturated sand lenses K = 2.1 gpd/ft²

 – Saturated Thickness is greater in Area C such that:



H = 10.5' h = 3'

So: $Q = \dfrac{(K)[H^2 - h^2](x)}{2880\,(L_o)}$

K = 2.1 gpd/ft
H = 10.5'
h = 3'
x = outside perim. Area C = 584 ft

L_o = (next page)

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 10 OF
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III Area C, (cont'd)

III B. (cont'd)

$$L_o = (\text{estimate})\ 3(H-h)\sqrt{K}$$

where $K = \mu/sec$

$$= 3(10.5-3)\sqrt{1.0\,\mu/sec}$$

$$= 22.5\text{ ft}$$

then:

$$Q_{Area\ C} = \frac{(2.1)(10.5^2 - 3^2)(584)}{(2880)(22.5)}$$

$$\boxed{Q_{Area\ C} = 1.92\text{ gpm} \cong 2.0\text{ gpm}}$$

Note: that flow is only calculated from the face of the trench that will accept regional flow.

III C Vertical Flow Component of Dewatering Rate in Area C

(1) The calculations presented in Section: IB and II B were for horizontal flow only. The estimate of flow in III B, (Area C) did not address the potential for upward vertical seepage from the sand and gravel unit in Area C.

AWD TECHNOLOGIES

CALCULATION WORKSHEET

CLIENT: ECC Trust	FILE NO.: 2259-820	BY: DAR	PAGE 11 OF
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III, C (cont'd)

(2) The pumping test of CP-TP-01 showed potential hydraulic influence from the sand and gravel unit. The test was not of sufficient duration to present quantitative data on the degree of influence. However a rough assumption can be made through a simplified flow net diagram where:

- Area C = SA = 31,318
- If Area C is constructed to be square, then its dimensions would be 180 ft x 180 ft.
- Area C could then be separated into 16 equal-area blocks

- If flow is limited to only vertical flow through each block then

$$Q = (m)(K)\,dh$$

where m = no. of areas between flow lines

K = hydraulic conductivity in meters/sec

dh = change in head across the flow region

- This flow condition also assumes the dewatered condition has been achieved in the target zone and that the sand and gravel unit is an endless recharge boundary.

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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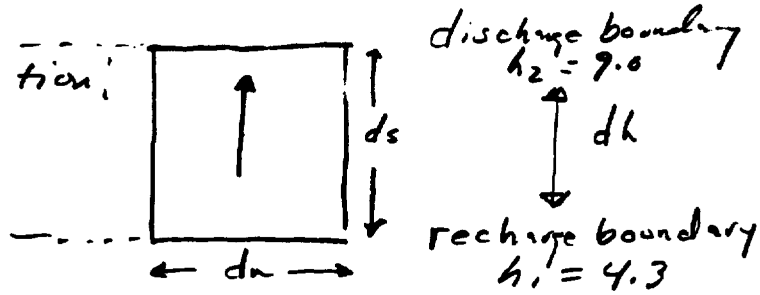
III. (cont'd)

III C. (cont'd)

(2) (cont'd)

In section:



$M = \frac{4 \text{ stream tubes}}{4 \text{ block model}}$ in 4 block x

$K_v = 1.0 \times 10^{-5} \text{ cm/sec} = 1.0 \times 10^{-7} \text{ m/sec}$

5' = 1.5 m

$dh = h_1 - h_2 = 4.7 \cong 5.0$ (upward)

$Q = (4)(1.0 \times 10^{-7})(1.5 m)$

$Q = [6.0 \times 10^{-7} m^3/sec]$ [meters of section perpendicular to flow net]

180 ft ≅ 55 m

$Q = [6.0 \times 10^{-7} m^3/sec][55 m]$

$= 3.3 \times 10^{-5} m^3/sec$

$= (3.3 \times 10^{-5} m^3/sec)(35.31 ft^3/m^3)(7.48 g/ft^3)(60 sec/min)$

$\boxed{= 0.52 \text{ gpm}}$

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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III (cont'd)

III C. (cont'd)

The simple flow net analysis yields a flow rate that is lower than the short-term rate obtained during the CP-TP-01 pumping test.

A second simplified calculation yields a significantly greater estimate as follows:

$$\text{Total Flow} = Q_{Horizontal} + Q_{Vertical} + Q_{HV\ 90° < \theta < 180}$$

If $Q_{90° < Q_{HV} < 180°}$ is simplified by assuming that $Q_{Vertical\ total} = Q_V + Q_{HV\ 90° < Q_{HV} < 180°}$ where Q_{HV} approaches Q_V then:

$K_V = K_h/10$

$$Q_{V\ total} = (K_V)(i_V)(SA_{Area\ C})$$

$$K_V = (1.0 \times 10^{-5}\ cm/sec) = 0.21\ gpd/ft^2$$

$$i_V = \frac{h_{1\ sand+gravel} - h_{2\ pumping\ level\ in\ trench}}{\text{Depth to sand and gravel} - \text{Depth to trenches}}$$

$$= \frac{4.3 - 9.0}{20 - 9.0}$$

$$= 0.43 \text{ upward gradient}$$

$$SA = 31,318$$

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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III. C. (cont'd)

$$Q_{v\,total} = (0.21\,gpd/ft^2)(0.43)(31\,318\,ft^2)$$

$$\cong 2828\ gpd$$

$$\boxed{\cong 2.0\ gpm}$$

This estimate is directly proportional to the estimated vertical hydraulic conductivity. For example, if Kv increased one order of magnitude to 1.0×10^{-4} cm/sec then the estimate would be 19.6 gpm.

Summary: The simple flow net calculation is within 0.5 orders of magnitude of the simplified Darcian Estimate. From the Phase II SI field data, the greater flow estimate is better used for water management requirements

III D. Summary of Maintenance Dewatering Rate Calculations

(1) Area A = 1.12 gpm Horiz + 0 vert
Area B = 0.33 gpm Horiz + 0 vert
Area C = 2.0 gpm Horiz + 2 vert

Approx = 3.5 gpm Horiz 2 vert

$\boxed{= 5.5\ gpm\ total}$

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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IV Approximate Time To Dewater Initial Stored Volume

Note: General assumption is that the alternating trench approach (gravity drainage) will be used.

IV A. Area A

(1) $v = (K_H)(i_h)$

v = flow velocity
K = horiz hydraulic conductivity
i_h = horizontal gradient (induced)

$K = 1.0 \times 10^{-5}$ cm/sec $= 0.03$ ft/day

$i = b / \text{distance between trenches } (R_o)$

$b = 4$ ft (94 ocs - 54 ocs)

$R_o = 10$ ft.

$= 4/10 = 0.40$

$v = (0.03 \text{ ft/day})(0.40) = \boxed{0.012 \text{ ft/day}}$

(2) $Q = (V)(A)$

$V = 0.012$ ft/day

$A = (\text{avg length trench area})(\text{avg width})$

$A = (265 \text{ ft})(2 \text{ ft})$

$A = 530 \text{ ft}^2$

$Q = (0.012)(530) = \boxed{6.36 \text{ ft}^3/\text{day}}$

(3) Volume of water per trench

$V = (L)(a)(b)(n)$ $\quad n$ = porosity (effective)

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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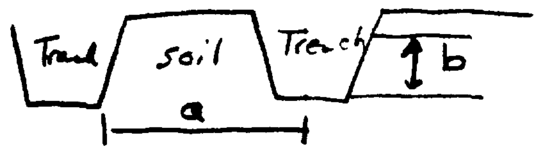
IV. (cont'd)

IV A. Area A (cont'd)

(3) (cont'd)



$V = (265 ft)(10 ft)(4)(0.10)$

$V = 1060\ ft^3$

(4) $t_{days} = Volume / Q$

$= 1060\ ft^3 / 6.36\ ft^3/day$

$\boxed{\cong 160\ days}$

IV B. Area B [same assumptions as Area A]

(1) $v = K_h i_h = (0.03\ ft/day)(0.40)$

$= 0.012\ ft/day$

(2) $Q = va \quad a = (120 ft)(2 ft)$

$= 240\ ft^2$

$Q = (0.012)(240)$

$\boxed{= 2.88\ ft^3/day}$

(3) $Vol = (L)(a)(b)(n)$

$= (120)(10)(4)(0.10)$

$= 480\ ft^3$

(4) $t_{days} = V/Q = 480\ ft^3 / 2.88\ ft^3/day$ $\boxed{\cong 160\ days}$

AWD021 5/90

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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IV. (cont'd)

IV C. Area C

Assumptions

- Dewatering time for gravel is considered to be "fast" and is not estimated
- Horizontal Flow Conditions only
- $K = 1.0 \times 10^{-4}$ cm/sec $= 3.0$ ft/day

(1) $v = (K_h)(i_h) = (3.0 \text{ ft/day})(0.40)$

$\boxed{= 0.12 \text{ ft/day}}$

(2) $Q = (v)(a)$ $\quad a = (150 \text{ ft})(2 \text{ ft})$

$\boxed{= (300 \text{ ft}^2)(0.12) = 36 \text{ ft}^3/\text{day}}$

(3) $\text{Volume} = (l)(a)(b)(n)$ where $n = n_{till} = 0.10$

$= (150)(10)(4)(0.10)$

$= 600 \text{ ft}^3$

(4) $t = V/Q = 600 \text{ ft}^3 / 36 \text{ ft}^3/\text{day}$

$\boxed{\cong 17 \text{ days}}$

AWD TECHNOLOGIES

CALCULATION WORKSHEET

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SUBJECT: Attachment to Revision I Phase II SI Dewatering Calcs.		CHECKED BY:	DATE: 3-24-93

I. Dimensions of Designated Areas

A. Area A

(1) Rectangular area at north end of site (primarily north of the old sludge pond)

(2) Surface Area = 83,424 ft^2

(3) Total Perimeter = 1160 ft

(4) "Outside" Perimeter = 1040 ft

B. Area B

(1) "Panhandle Area" between southern border of Area A and north end of Concrete pad

(2) Surface Area = 18,600 ft^2

(3) Total Perimeter = 548 ft

(4) "Outside" Perimeter = 308 ft

C. Area C

(1) South end of site - covered by concrete pad

(2) Surface Area = 31,318 ft^2

(3) Total Perimeter = 704 ft

(4) "Outside" Perimeter = 584 ft

"outside" perimeter = total perimeter - that portion of perimeter that will be "under the cap"